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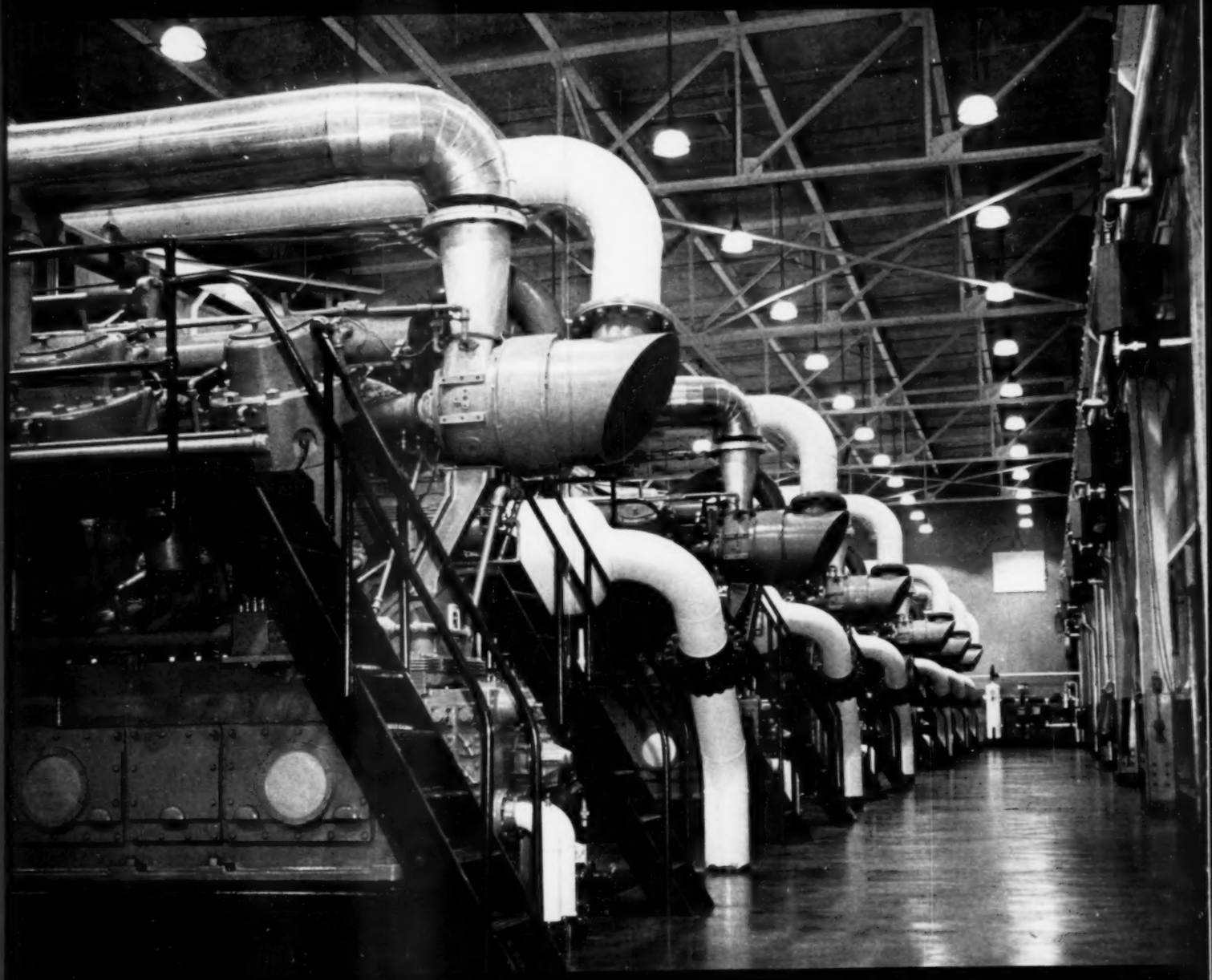

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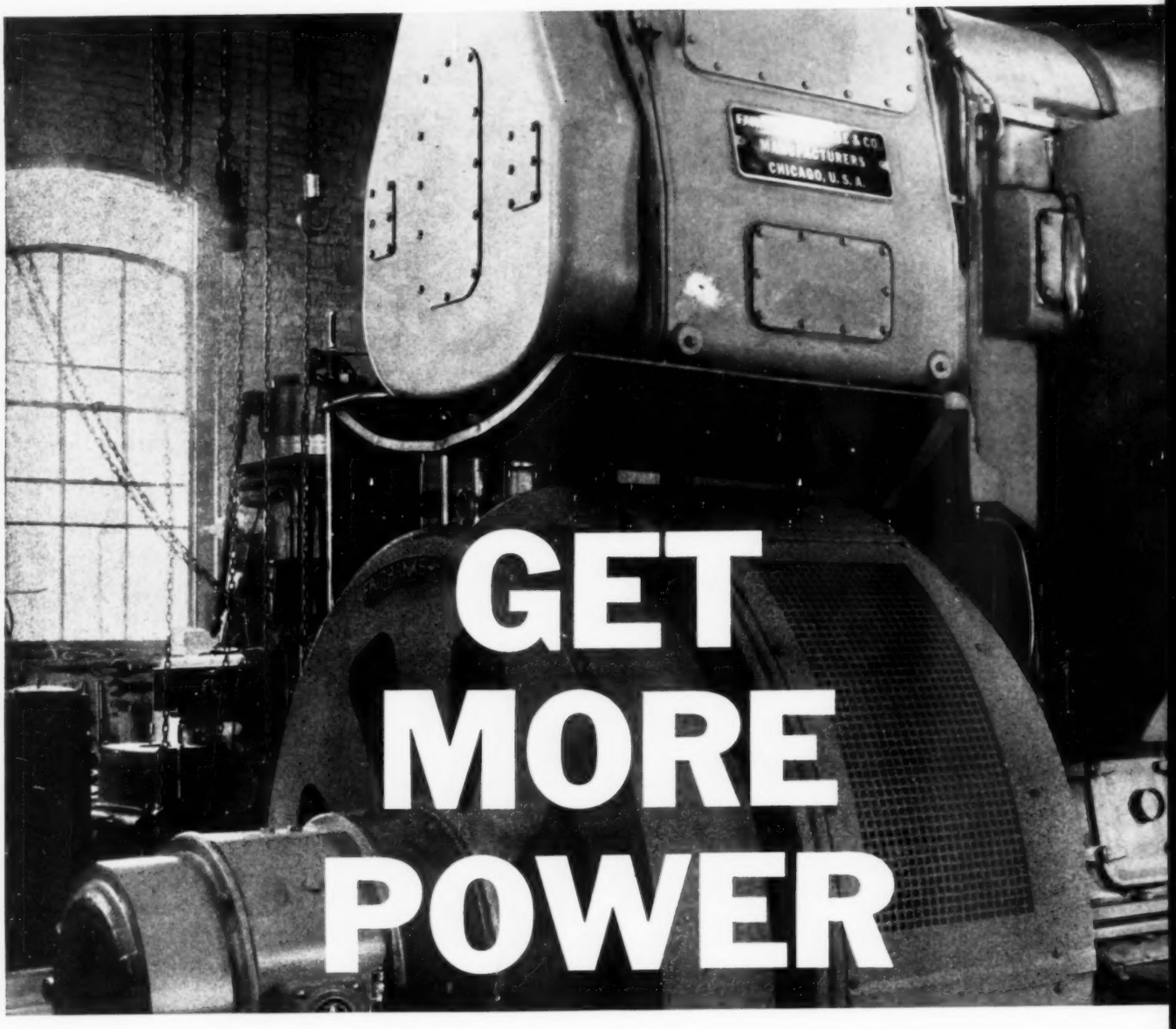

from
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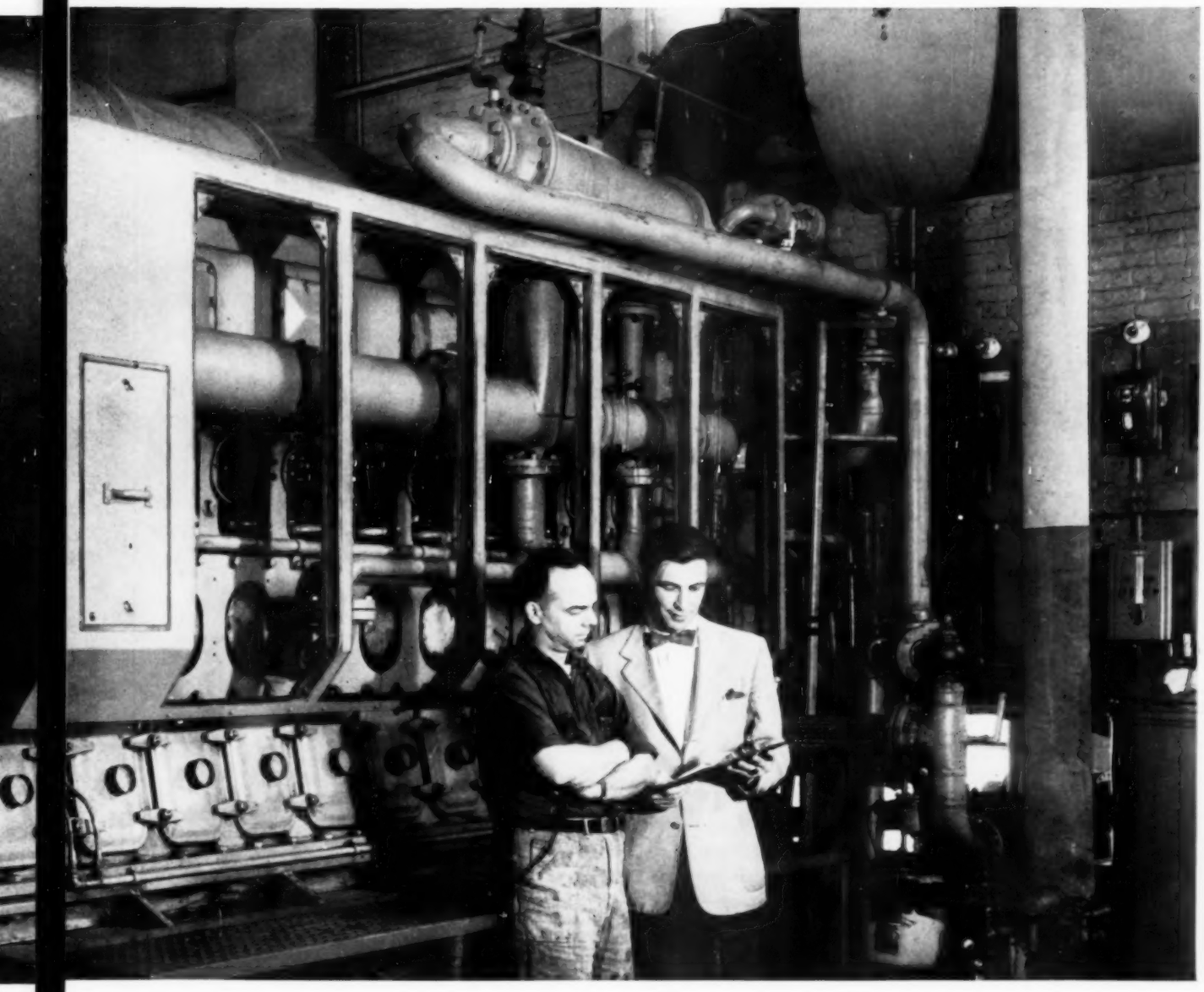
with
Texaco Ursa Oil Heavy Duty



You get more power from diesels lubricated with Texaco Ursa Oil Heavy Duty because you can be sure the engine will stay free of sludge and harmful deposits. Valves stay clean, and rings stay free, to give you full compression and complete fuel combustion.

Complete combustion of fuel means full power—and less fuel per horsepower. Texaco Ursa Oil Heavy Duty is fully detergent and dispersive—holds all the power-robbing contaminants so the engine itself stays like new: economical, reliable, with fewer overhauls.

There is a complete line of Texaco Ursa Oils for diesel, gas and dual-fuel engines. Your local Texaco Lubrication Engineer will gladly help you choose the right ones for your application. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

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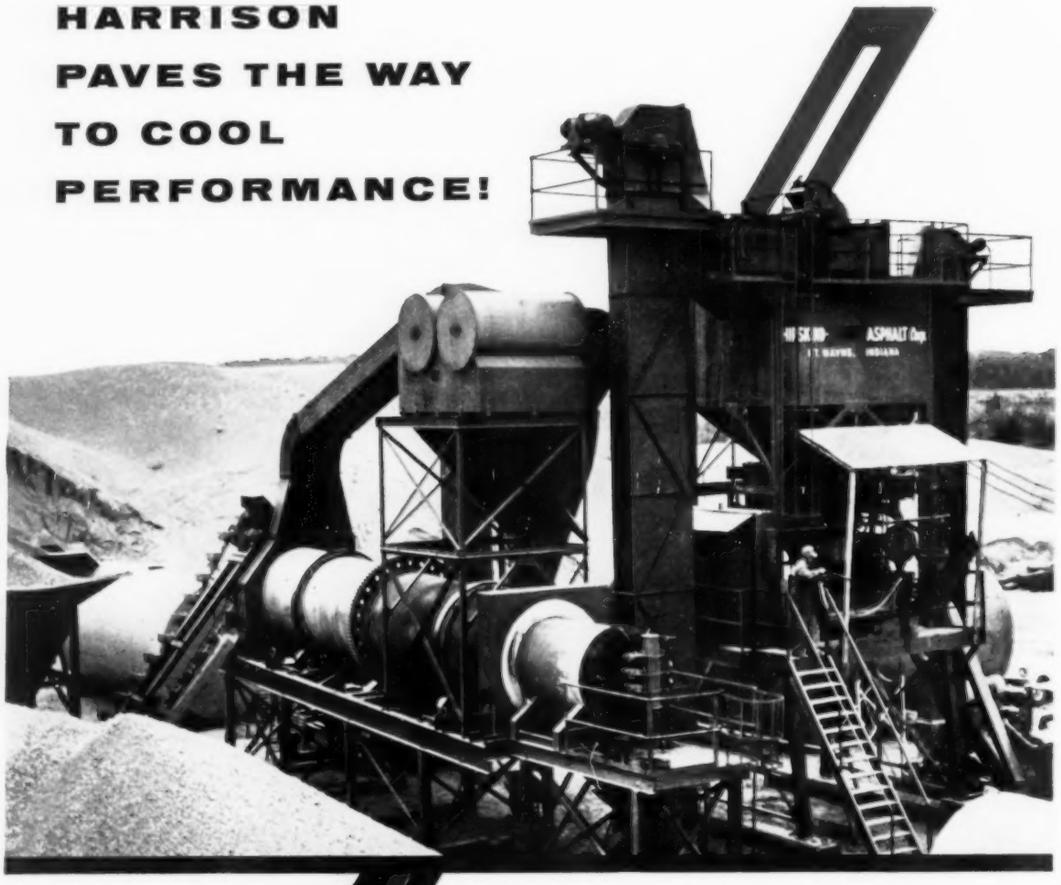

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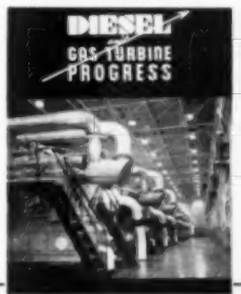
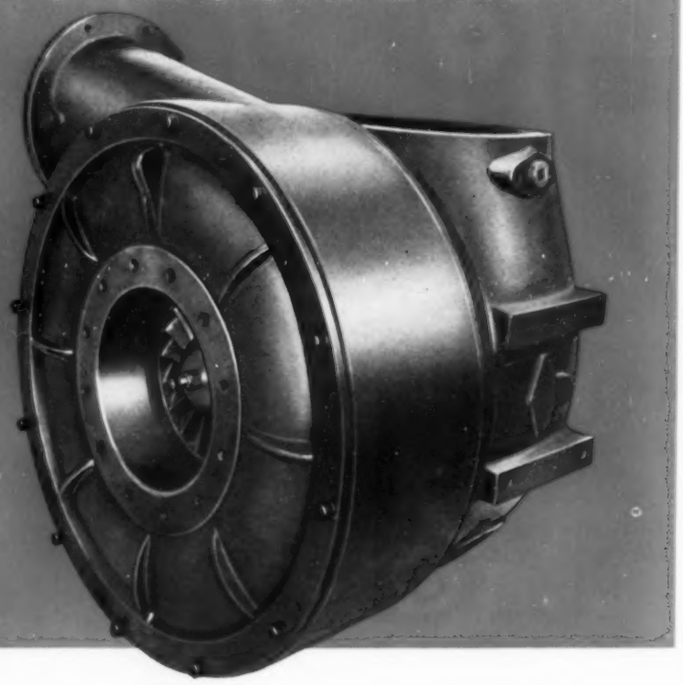


FRONT COVER ILLUSTRATION

Six 2000 hp Ingersoll-Rand turbocharged gas engine driven 2-stage gas compressors housed in Westcoast Transmission Co. Ltd.'s Compressor Station #1, at Taylor, B.C.

ELLIOTT TURBOCHARGERS

also serve 2-cycle engines.



Elliott has 18 years of *unmatched turbocharger background.*

This successful, simplified precision rotor—the only moving part—stands up to high operating speeds and extreme temperature variations.

No other manufacturer in the United States has so much experience in building turbochargers. Elliott covers the whole field of turbocharged engines.

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Jeannette, Pennsylvania

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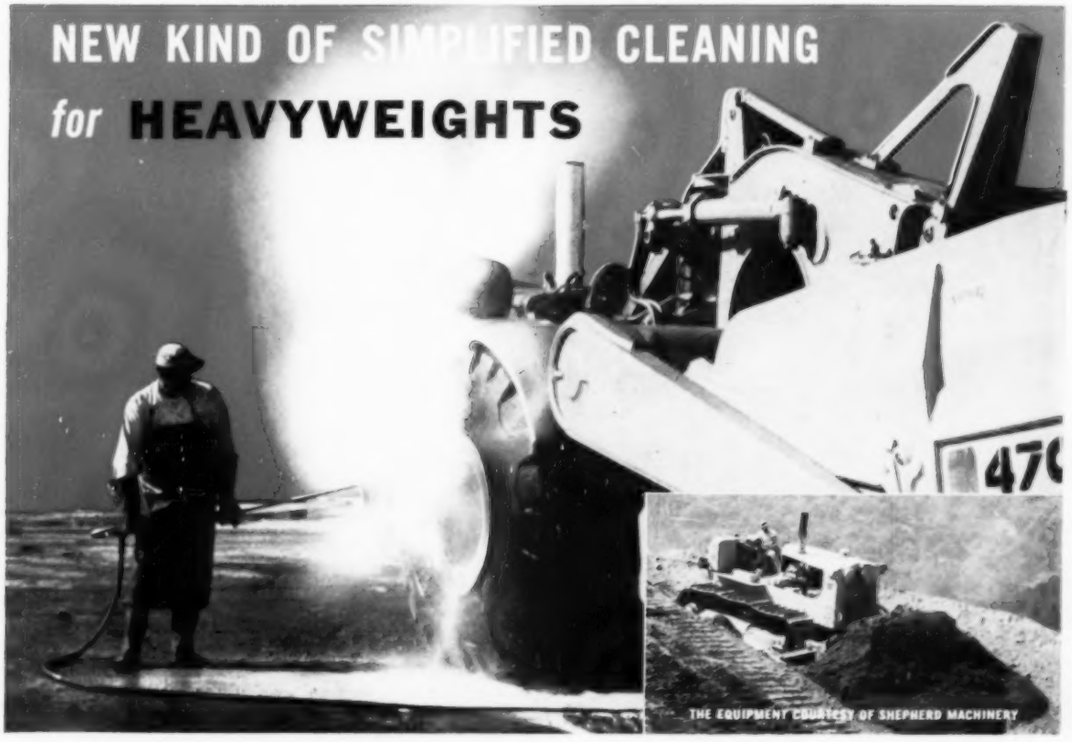

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Clayton-SELLERS COMBINATION STEAM and HYDRAULIC JET CLEANER!

Clayton Manufacturing is proud to announce a new, revolutionary type of steam and hydraulic cleaner. The Clayton-Sellers is designed specifically for cleaning off highway, fleet, marine, petroleum and heavy industrial equipment of every type.

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SAVES FUEL...SAVES TIME...CLEANS FASTER AND BETTER

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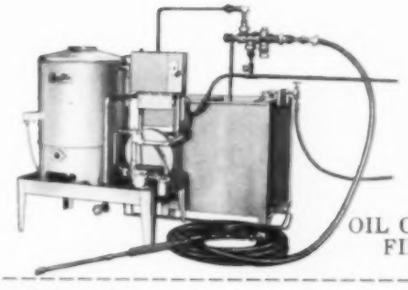

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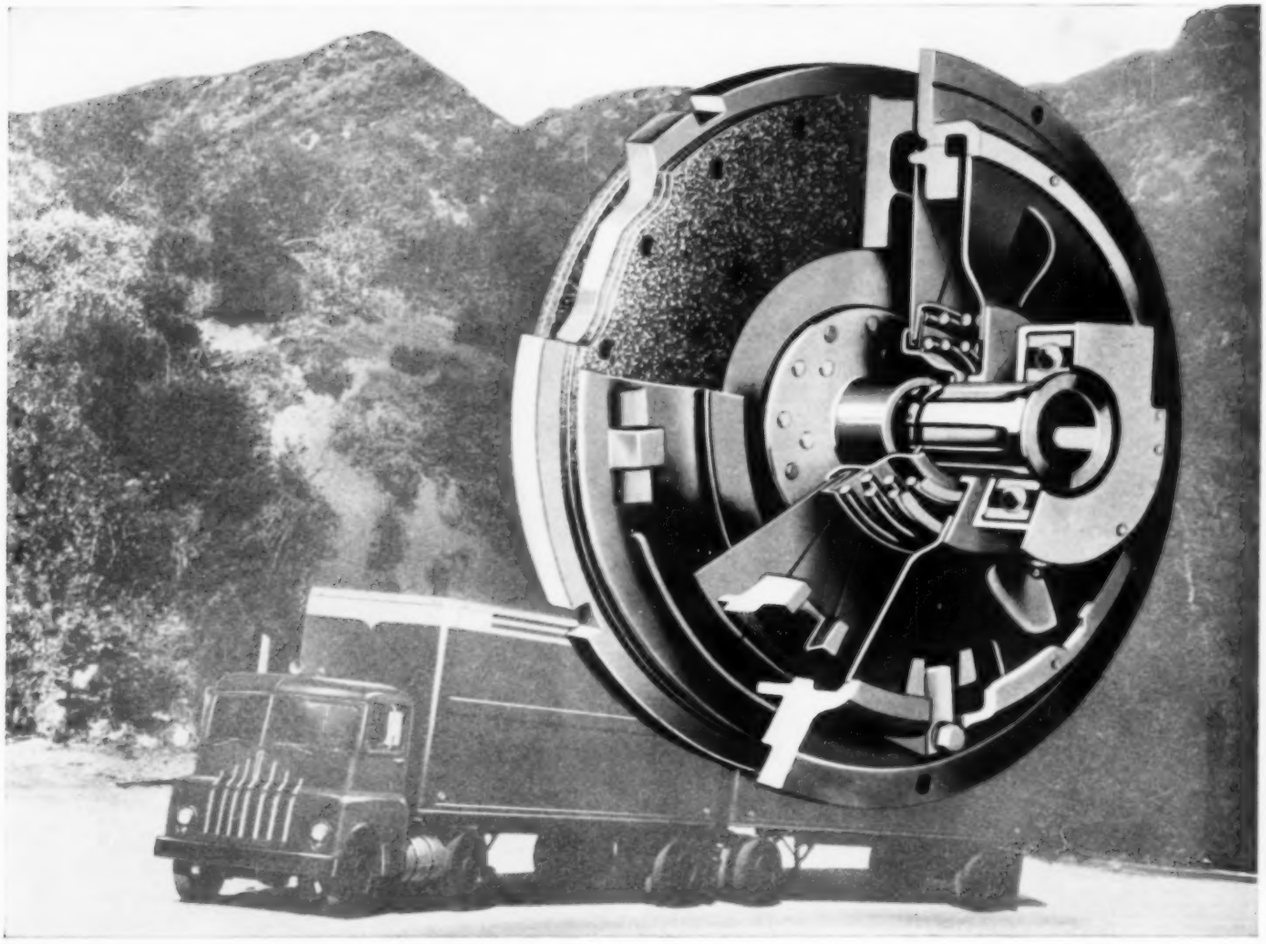

Western Fleets Report:

150,000 to 200,000 trouble-free miles from Spicer H-D Clutches

Western terrain means rugged service for clutches. Yet, one West Coast operator says, "The only time we touch the Spicer Clutch is at the end of 200,000 miles. Then, we rebuild the engine and overhaul the clutch — whether it needs it or not."

Still another fleet owner states, "We don't even bother with preventive maintenance for our Spicer Clutches. They're absolutely trouble-free from one overhaul period to another — or about 150,000 miles."

Make sure your clutches last at least as long as the engine by installing Spicer Heavy-Duty Clutches. They're available in a unitized assembly . . . including release bearing, bearing housing and yoke. Specify Spicer on your next job.

For further information or technical assistance contact the Dana Engineer.

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ENGINEER'S FIELD REPORT

PRODUCT **RPM DELO OIL RR**

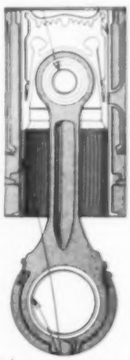
FIRM **BAMBERGER RAILROAD CO.**
Salt Lake City, Utah

5 years without overhaul on RPM DELO Oil

Lubricated with RPM DELO Oil RR since going into service, three switch locomotives of Bamberger Railroad have worked over five years without a major overhaul. "The oil does such a good job of protecting engines that I've never had to repair or replace a part because of faulty lubrication," says General Shop Foreman J. F. Buckley (below). "Every time we've opened the engines for inspection we've found them clean, free of carbon or lacquer deposits." Bamberger hauls general freight between lines of UP, WP, SP, and D&RGW over 36.9 miles of its own mainline track between Salt Lake City and Ogden.

Clean piston (above) has no measurable wear, shows the kind of performance Bamberger gets with RPM DELO Oil RR. "We simply wipe off parts and they're bright and shining," says Mr. Buckley. Firm's EMD 800's (#601 top right, #602 above) deliver cars to sidings and make up trains for larger locomotive—work an average of 16 hours a day. Engine #570 (top left) makes the Salt Lake-Ogden run, works 10 to 12 hours daily.

Why RPM DELO OIL RR reduces wear, corrosion



- Oil stays on engine parts—hot or cold, running or idle
- Anti-oxidant resists lacquer formation
- Detergent keeps parts clean
- Special compounds prevent corrosion of bearing metals
- Inhibitor resists foaming

For More Information about RPM DELO Oils or other petroleum products of any kind, or the name and address of your nearest distributor, write or call any of the companies listed below.

LUBRICATING OILS RPM DELO

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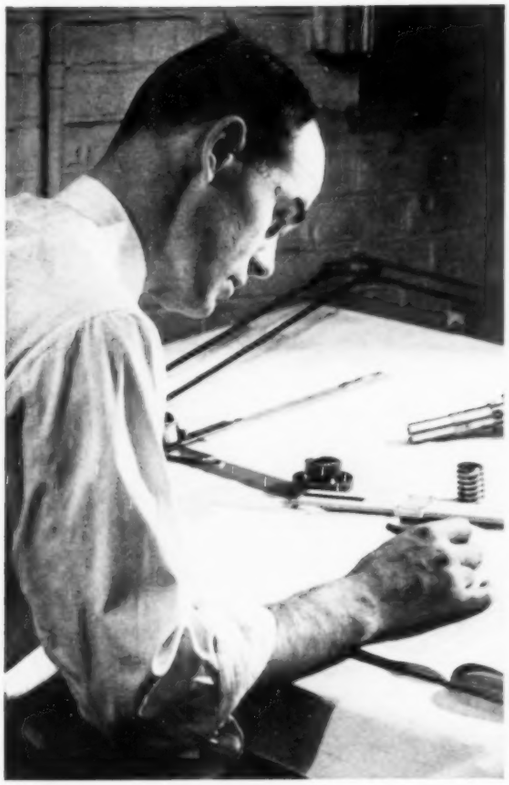
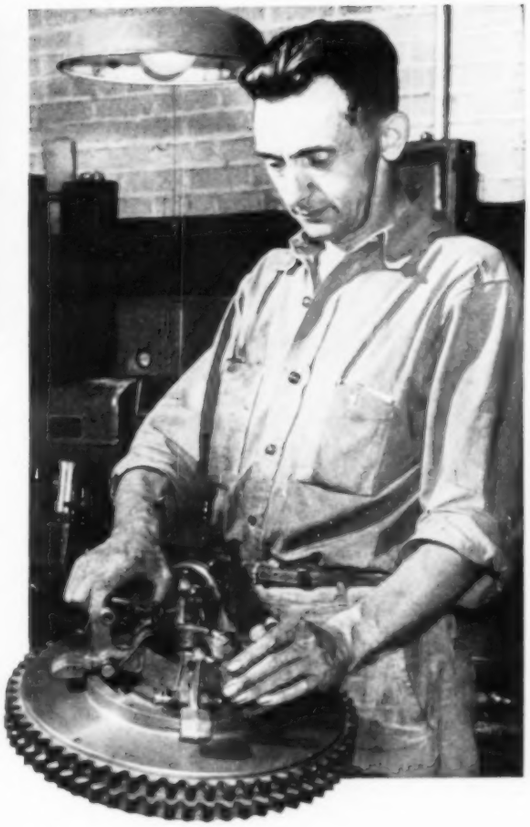
THE CALIFORNIA OIL COMPANY, Perth Amboy, New Jersey

STANDARD OIL COMPANY OF TEXAS, El Paso
THE CALIFORNIA COMPANY, Denver 1, Colorado





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Twin Disc Friction Clutches and Power Take-Offs are backed solidly by the largest parts and service network of its kind . . . to assure you prompt repair and parts replacement if ever needed . . . no matter where your equipment operates.

Twin Disc maintains 7 Factory Branches, with 36 Parts Stations and 89 Authorized Hydraulic Dealers located strategically throughout the United States . . . plus parts stocks at thousands of dealers who handle industrial machinery and equipment.

Twin Disc's extensive parts and service network is one of the reasons why Twin Disc products have been the preference among the leading equipment manufacturers for more years, on the widest variety of applications, than any other make of friction or fluid drive for industrial use. This service not only protects the over-all performance of the manufacturer's product—*it protects the user in the field.*

There's little wonder that Twin Disc is known and recommended in every industry . . . known for service it has given customers for almost 40 years . . . recommended for the quality and long life of its products.

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Twin Disc Clutch Company, Racine, Wisconsin; Hydraulic Division, Rockford, Illinois.

TWIN DISC

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Friction Clutches and Fluid Drives

FOR ANY LUBE SYSTEM PROTECT YOUR ENGINES WITH

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CFC FILTERS

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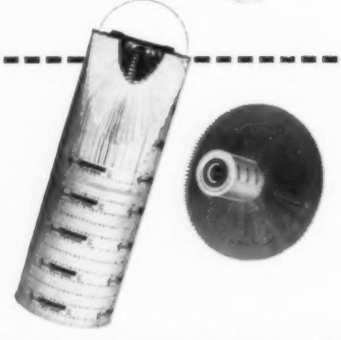
Fulflo Filters with genuine Honeycomb Filter Tubes provide true depth filtration at high or low flow rates for stationary engines, mobile engines or bulk fluids. Every drop is filtered finer and finer — through hundreds of precision controlled filtering tunnels. These diamond-shaped tunnels are engineered for exact uniformity in size, shape, depth and density. Contaminants are securely trapped in inner storage cells.

For Full-Flow SURFACE Filtration:

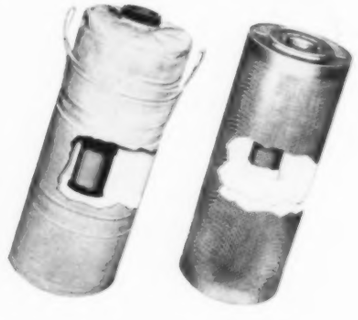
CFC Flo-Pac is offered in a variety of models using 1 to 36 resin-impregnated paper cartridges. Each cartridge provides more than 6300 square inches of filtering surface.



For By-Pass Systems:

CFC Multi-Cartridge Filter offers seven types of interchangeable cartridges — inert media for solid contaminants or Cranite (fuller's earth) for removal of solid particles and all products of oxidation. CFC Michiana Filters are also available in a variety of models for rugged service within minimum space requirement.

For new catalog, write today to Department DS



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MELROSE 76, MASSACHUSETTS
PLANTS IN MELROSE, MASSACHUSETTS AND LEBANON, INDIANA

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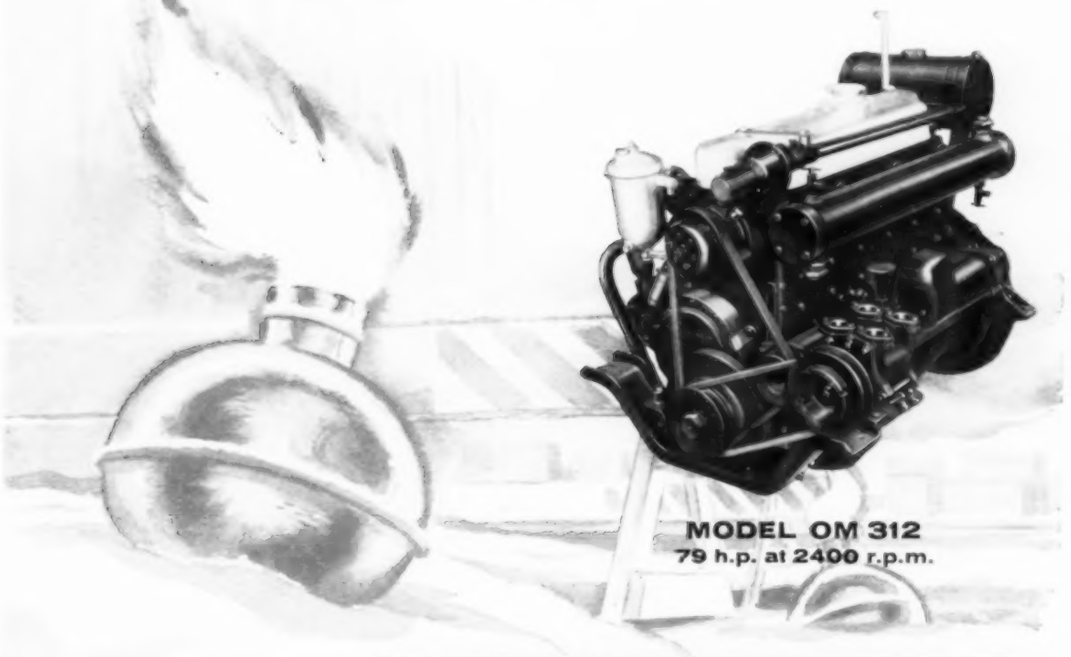

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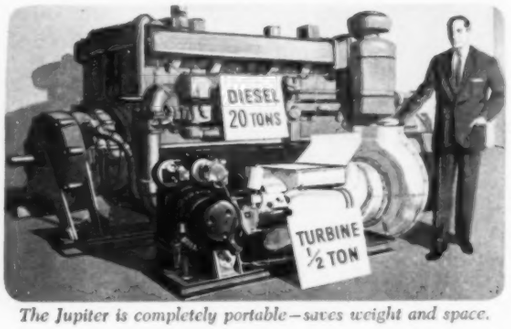
Natural gas.



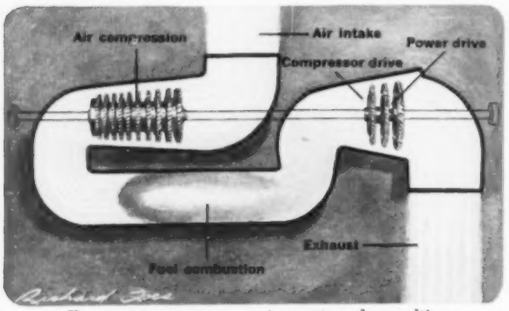
The Jupiter is completely portable—saves weight and space.

❶ Uses whatever fuel you've got!

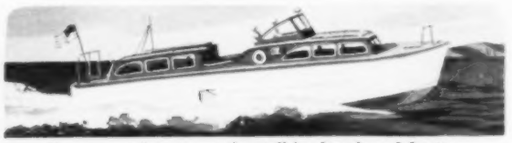
Solar gas turbines can operate on almost any available fuel—fuel that costs the least for *your* particular operation. Located in remote areas, for instance, self-sufficient Solar turbines can take fuel directly from a gas pipeline! This often results in lower total operating costs.

❷ Light—500 hp in 1/5 the space!

Solar's 500 hp Jupiter® engine is only one-fifth the size of a diesel of similar horsepower—and weighs *forty times less!* The entire unit is easily transported to remote locations. And it is especially suited to applications where space limitations create a troublesome installation problem.



Few moving parts, no reciprocation—longer life.



Instant acceleration—takes full load without laboring.

Instant emergency power.

Starts in any climate.

❸ Simple design—low maintenance!

Gas turbines are the simplest of all heat engines. In operation, large volumes of air are drawn in by the compressor, mixed with fuel in the combustion chamber, greatly expanded, and delivered to a turbine which produces shaft power. Routine servicing can be completed in a few hours at most. Overhauls are infrequent. Simple design and low maintenance make gas turbines ideal for a wide range of important applications—including boat propulsion, portable power generation, air compression and chemical processing. And other applications for these versatile power plants of the future are limited only by the imagination.

❹ Starts instantly—no warm-up!

Solar gas turbines can be turned on or shut down in seconds. And they require no warm-up—even after long periods of stand-by service. No matter what your business, no matter what your power needs, these amazing advantages can benefit you. Write to Dept. F-29 for free gas turbine brochure.

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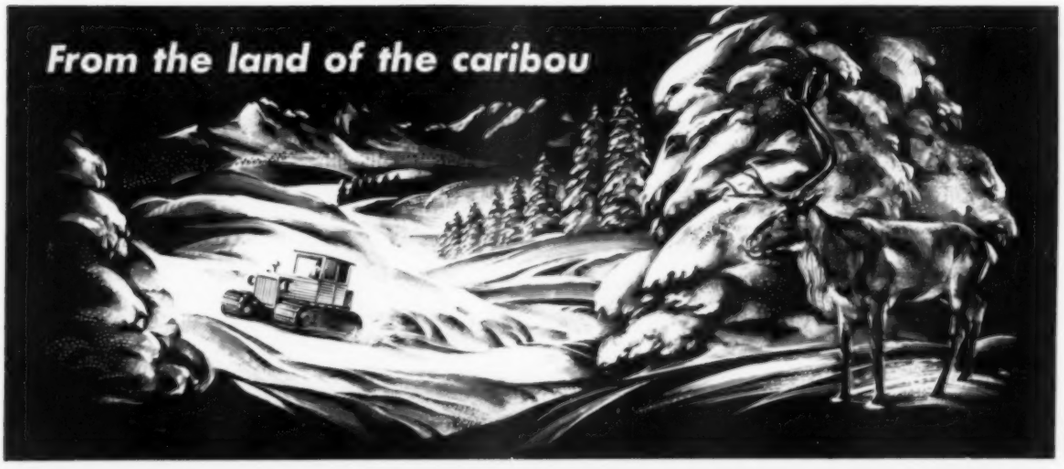

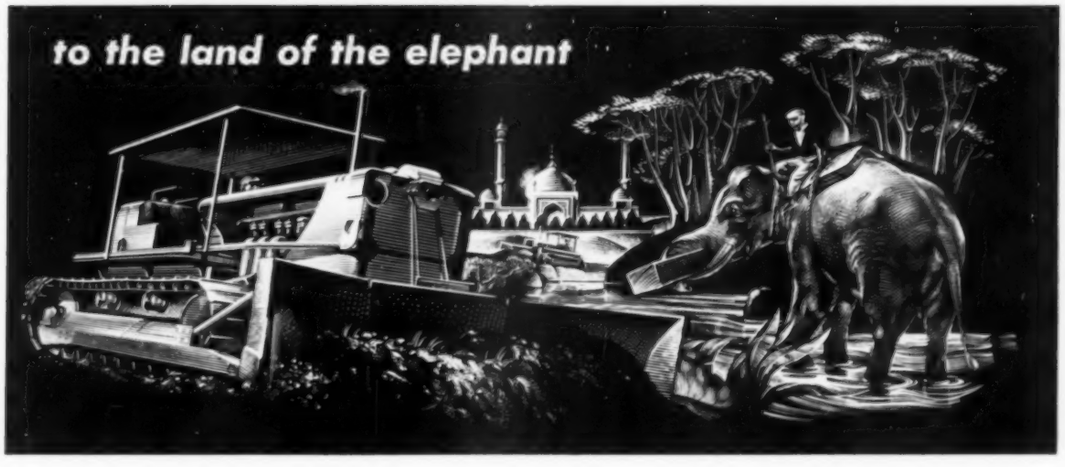

Other Outstanding Shell Industrial Lubricants

Shell Tellus Oils—for closed hydraulic systems

Shell Talona R Oil 40—anti-wear crankcase oil for diesel locomotives

Shell Alvania Grease—multi-purpose industrial grease

Shell Turbo Oils—for utility, industrial and marine turbines

Shell Dromus Oils—soluble cutting oils for high-production metal working

Shell Macoma Oils—for extreme pressure industrial gear lubrication

Shell Voluta Oils—for high-speed quenching with maximum stability

Its performance and name are the same around the world

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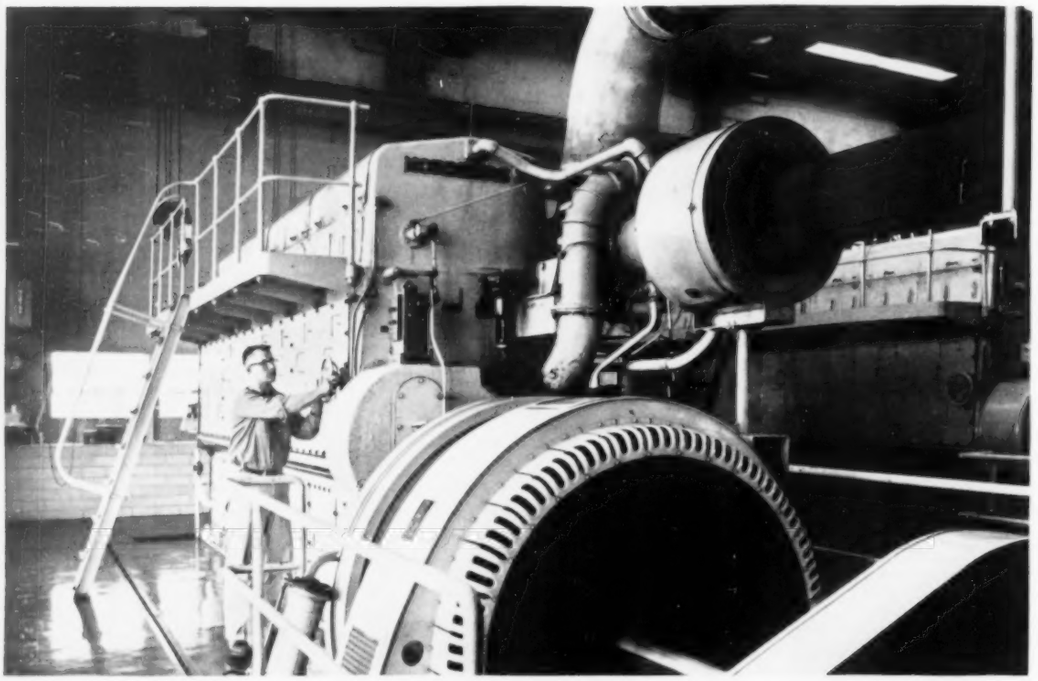

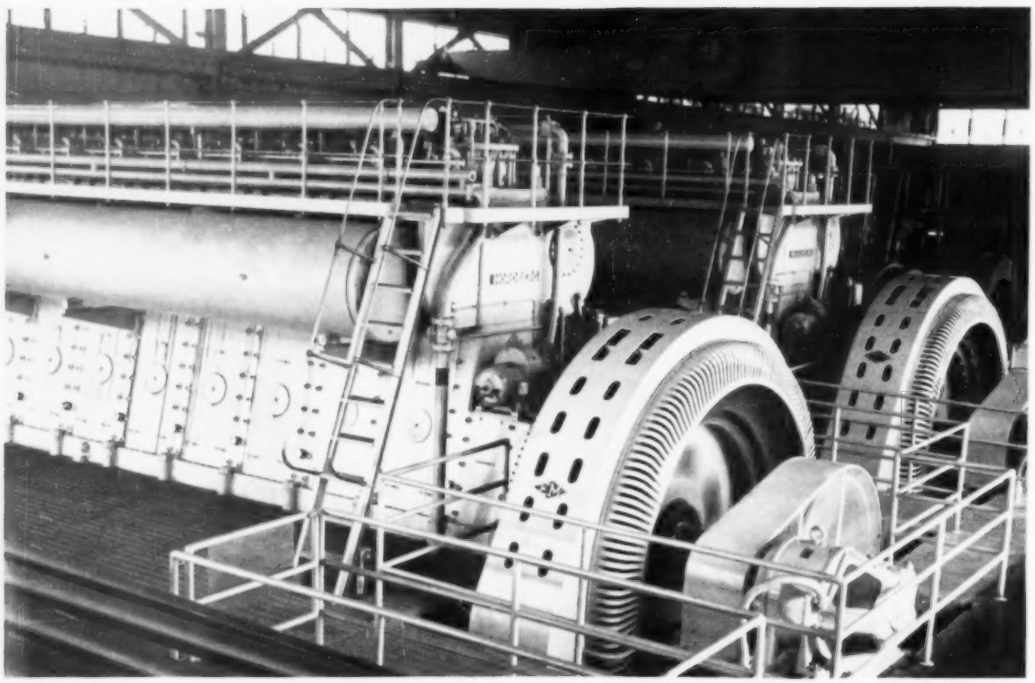

Nordberg engines have long been recognized for dependability and economy in electric power generation for REA plants in many parts of the country.

It is significant that the top two Awards for 1957 made by the publication *DIESEL PROGRESS* for the "*Most Efficiently Operated of All REA Internal Combustion Plants*" were made to plants using Nordberg engines. Of equal importance, the Awards are a tribute to sound management and good teamwork in these plants. Their operating records fully evidence the sound application of Diesels for REA power.

DIVISION A

Jackson, Minnesota . . . owned by Federated Rural Electric Association. Powered by four 1750 hp Nordberg four-cycle, 8-cylinder turbocharged Duafuel® engines, totaling 7,000 hp, 4,920 kw.

During 1957, the Nordberg engines operated 19,822 hours and generated 16,477,900 gross kwh at a total cost of 11.54 mills/kwh. Total net production expenses amounted to only 7.132 mills/kwh, and the adjusted cost for the contest (fuel figured at 40¢/million BTU) brought the net production cost to 6.54 mills/kwh.

DIVISION B

Lea County Electric Cooperative—Lovington, New Mexico plant—was judged the most economical big power producer in the *Diesel Progress* contest.

Plant has nine engines, which in 1957 produced 47,387,000 kwh. Two newest engines are Nordberg 12-cylinder, 2-cycle Duafuel units, each rated 4000 kw. These units increased plant capacity 66% and produced over 16,000,000 kwh, virtually all of it in the last seven months of the prize-winning year.

Records show that all engines operated at very high efficiency with the two Nordberg engines producing at an average of 9908 BTU per kwh compared with the fine overall plant average of 10,118 BTU per kwh.

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P558

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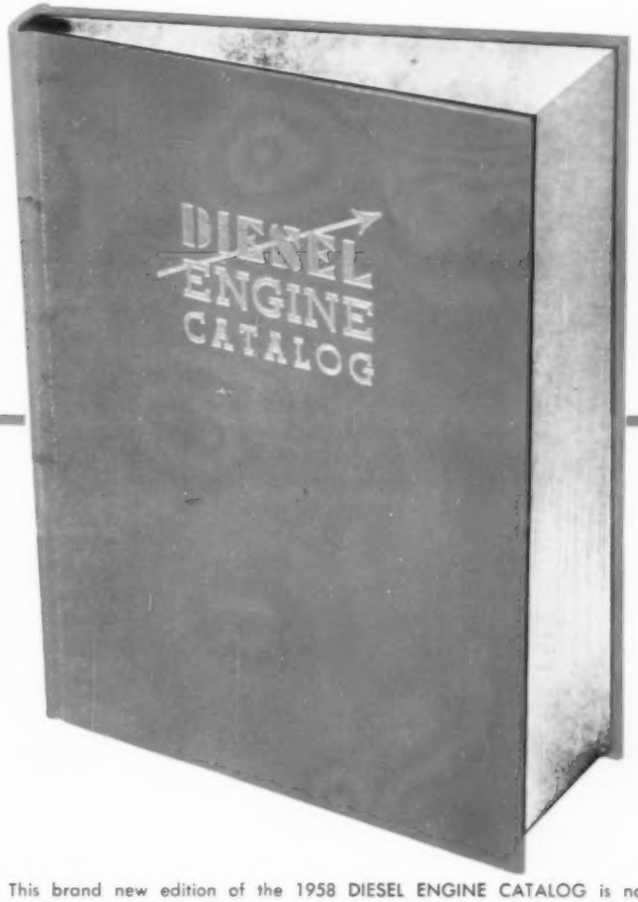

look at the contents

1. ENGINES—All major manufacturers of diesel, dual fuel and gas engines are represented in multiple page sections. Text is supplemented with specifications, power curves, photographs and sectional views.
2. TURBOCHARGERS and SUPERCHARGERS—This section of manufacturers is detailed and fully illustrated to give complete information on this increasingly important phase of the industry.
3. TRANSMISSIONS—The latest information on torque converters, fluid drives, and other modern means of transmitting power are fully described and illustrated in this section.
4. ACCESSORY EQUIPMENT—Recent developments in fuel injection systems, governors, and other key accessory units are detailed and illustrated fully in this section.
5. MARKET PLACE—A convenient, time-saving listing of sources from which you can obtain the multitude of items and services needed by the fast growing Diesel Industry.
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Two Fairbanks-Morse OP engines turn in top-rated performances with this lubricant.

The situation: In January of 1952 the Thief River Falls, Minnesota, municipal light plant put into service a 10-cylinder, 1,600 hp. Fairbanks-Morse opposed piston engine. In November, 1955, a 1,900 hp. Fairbanks-Morse OP engine was added.

What was done: The power plant management discussed lubrication requirements with Standard Oil lubrication specialists. Because of the evidence that STANDARD D&G Oil, with its higher additive level, could (1) reduce ring and wall wear, (2) reduce ring sticking, (3) increase bearing life and (4) reduce engine deposits, this oil was selected for the first engine installed. After 22,000 hours, inspection showed little or no wear. Small wonder then that when the second OP engine was put into service in 1955, STANDARD D&G Oil was again selected. After 7,500 hours, similar performance is being obtained on the newer engine.

Technical service performed by Standard Oil men pays off for the power plant management. Standard men take frequent samples for field inspection of oil condition. Other samples are regularly taken for transmittal to Standard's Whiting, Indiana, laboratory for complete analysis.

What you can do: Get more facts about STANDARD D&G Oil from the Standard Oil lubrication specialist near you in any of the 15 Midwest and Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

Taking a look at the record. Morris L. Owen, plant superintendent (left), and Standard Oil's Carl Klenner look at performance data on the two Fairbanks-Morse OP engines. Carl is a good one to talk things over with. He has been doing this sort of work for 10 years with Standard. Before that he received an engineering degree at the Michigan College of Mining and Technology and completed the Standard Oil Sales Engineering School.

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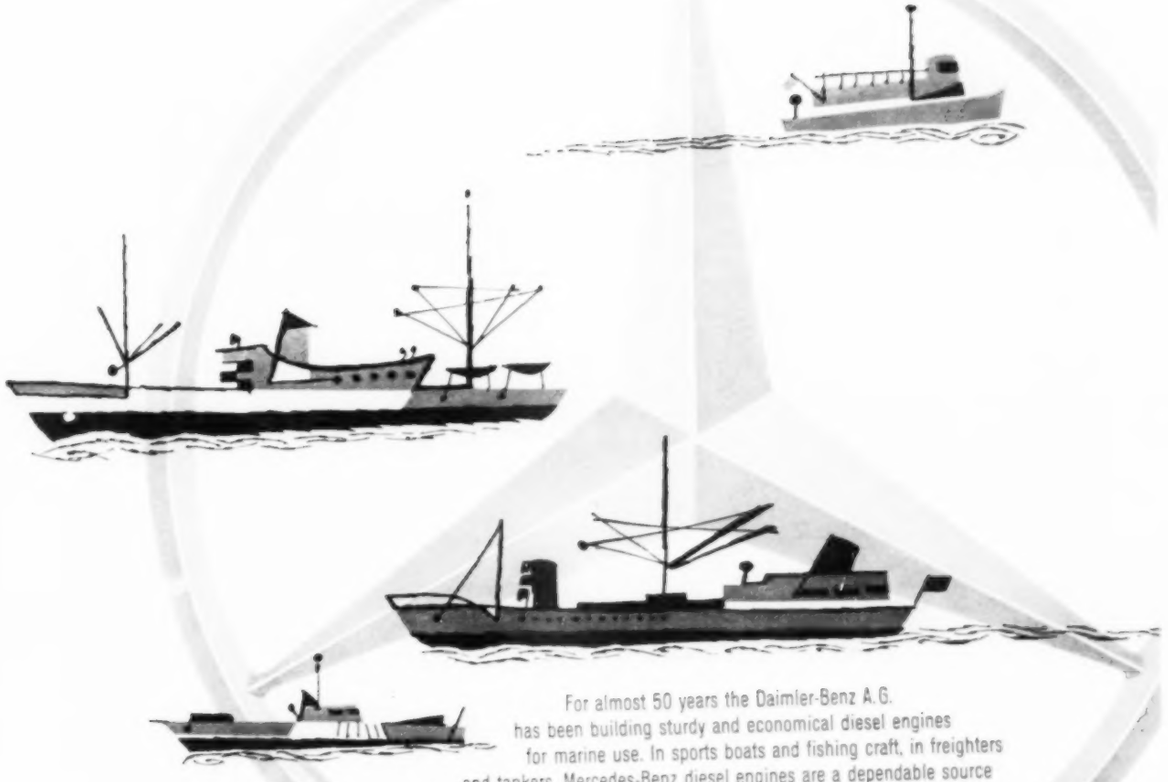

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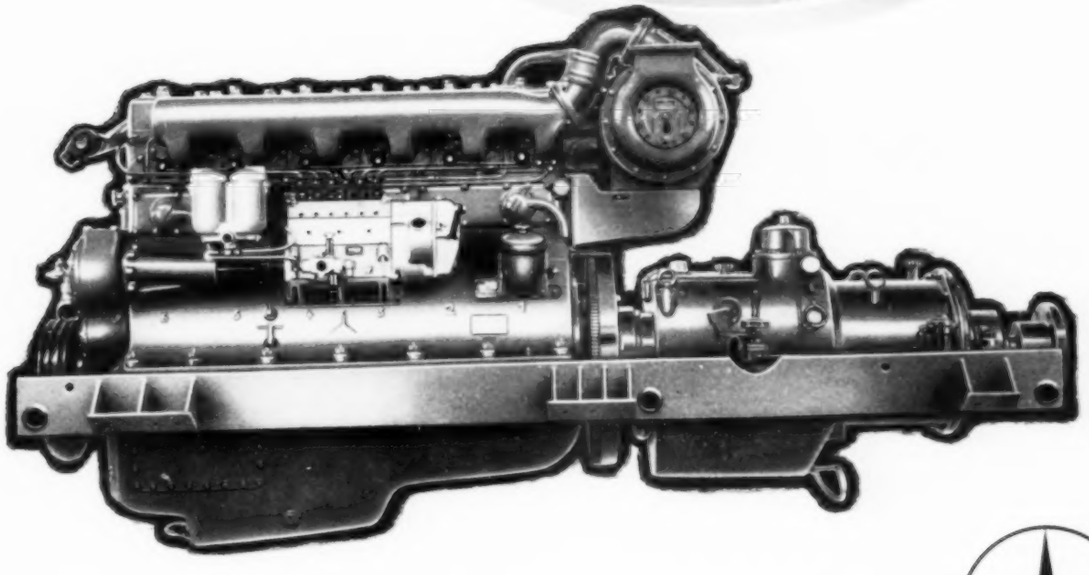

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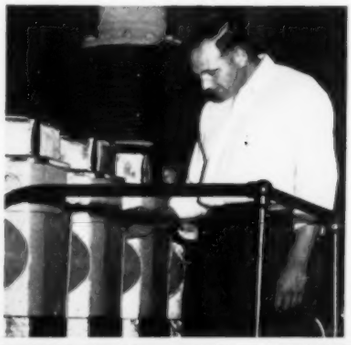
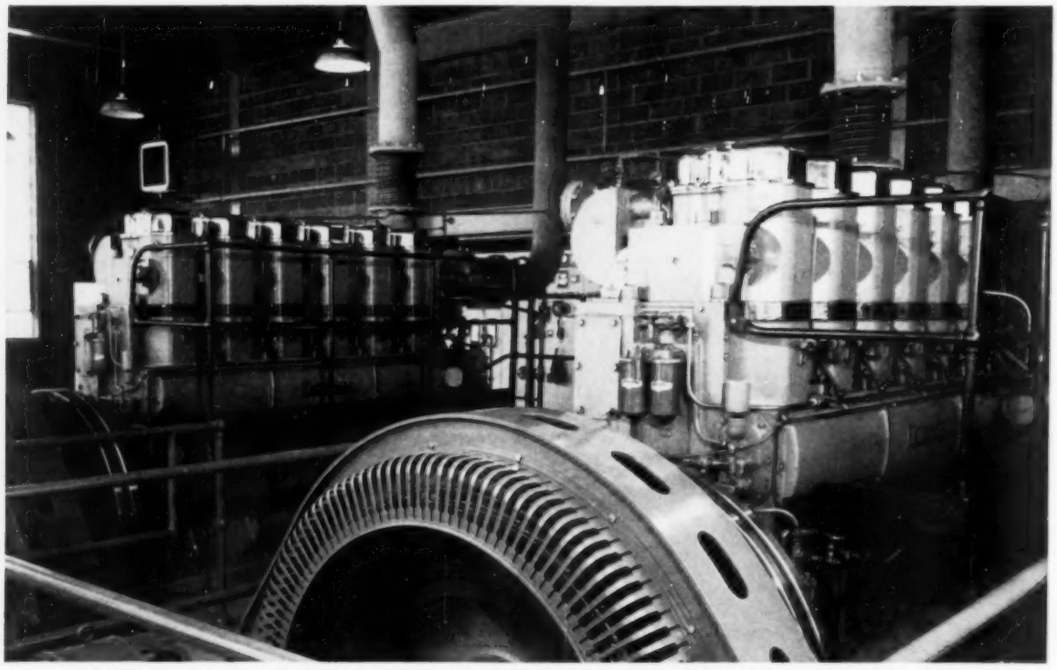
Clifford Severson

Manager, Municipal Power Plant,
City of Barnesville, Minn.





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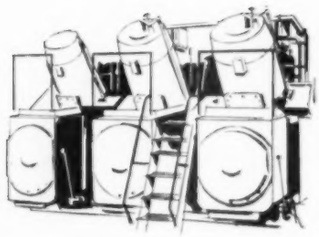

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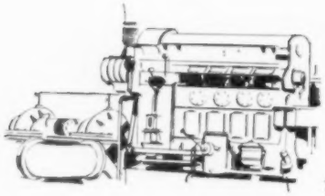
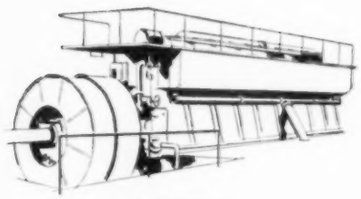


Pumping



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REA CONTEST WINNERS

LEXINGTON, Ky. April 7th. The ninth annual conference of the Rural Electric Generating Cooperatives was the opportunity for Bruce W. Wadman to present the DIESEL PROGRESS REA annual awards for the year 1957. The winning plant in Class A competition for internal combustion engine plants with an installed capacity of under 5000 kw was won by Federated Rural Electric Association in Jackson, Minnesota with a net adjusted production figure of 6.54 mills. Marvin J. Johnson, Assistant Manager, and Robert R. Staten, Chief Engineer, were on hand to receive the award for Jackson. The Class B competition for plants with an installed capacity of over 5000 kw was won by Lea County Electric Cooperative with their Lovington, New Mexico plant. This plant is the largest REA financed internal combustion engine plant with an installed capacity of 20,030 kw and their net adjusted production figure was 5.46 mills. Howard Clutts, Diesel Member of the Program Committee for the REA Conference accepted the award on behalf of R. B. Moore, Manager of Lea County Electric Cooperative, and his staff. Mr. Moore was unavoidably forced to miss the conference due to a bad windstorm they had in Lovington.

The Conference was well attended by Managers and operators of REA generating plants as well as members of the Diesel Industry. There was a definite air of excitement at the convention with the recent order from Washington to go ahead as fast as possible with pending applications for new generating units still fresh in many minds. With many REA systems growing with need for substantial expansion of generating facilities, the Lovington, New Mexico engine plant was a topic of much discussion. This plant had an actual production expense of only 3.72 mills per net kwh in 1957, before fuel adjustment, which is an outstanding performance record and proves that large engine plants are feasible and very practical. All too often, those who plan power generating facilities think of steam turbines automatically when a plant gets to the size of the 20,030 kw Lovington facility. The modern engines on the market today with their high thermal efficiences, the greater availability of natural gas as a fuel for dual fuel operation, and the flexibility of an engine plant in utilizing available power most effectively for maximum operating efficiencies are all factors that make large engine generating plants very practical and desirable. Lovington, with its excellent production record, is proof of this fact. The production record at Minnesota 37—Jackson was equally impressive with an adjustment fuel kwh expense of 6.54 mills with an installed capacity of but 4920 kw. As the plant stories on the next eight pages will tell you, efficient plant management, a rigid formula for loading each engine and a keen evaluation of the load factor past, present and future enabled these two fine plants to win the hotly contested DIESEL PROGRESS awards for the operating year of 1957. Next year (this year of 1958) we will again present two bronze plaques, one for Division A and one for Division B. The winners this year will rest on the side lines for 1958 and will not compete but they will be eligible to compete again in 1959. Hersey, Mich. which won the award three times in the prior eight years has "had it" and no longer competes. Caro, Mich. the winner of Division A in 1956 did not compete in 1957—the series just awarded, but will again be eligible to fight for the 1958 award.

The editors of DIESEL PROGRESS hope that our making these REA awards each year plus the descriptions of the winning plants and their operating records will help those who will be investing in new generating facilities to better evaluate their choice of types of prime movers more effectively and more profitably.

William H. Reed, Head of the Internal Combustion Plants Section of REA in Washington, attended the REA Conference, and we want to thank him and his associates for the splendid cooperation we have received in evaluating the figures leading to the REA awards. We wish Mr. Reed and all REA plants a successful year in 1958, which year promises to be highly competitive.

Table II
After Fuel Adjustment*

Project	Plant	Installed Capacity KW	Gross Generation MWH	Plant Factor %	Production Expense in Mills/Net KWH Actual	Adjusted*
Minn.—37	Jackson	4920	16478	38	7.13	6.54
N. Mex.—23	Lovington	20030	63483	36	5.72	5.46

*Fuel Costs Adjusted to 40¢ MM-BTU

Table I
Operating Data Of Certain REA-Financed Internal Combustion Generating Plants—Before Fuel Adjustment

Project	Location	Inst. Cap. KW	Gross Gen. MWH	Sta. Serv. %	Plant Factor %	R P C Factor %	Fuel Cost ¢ MM-BTU Gas	Fuel Cost ¢ MM-BTU Oil	BTU/KWH Gross	HP-HRS Per Gal. Lube	Labor Cost Oper.	Labor Cost Maint.	Maint. Matl.	Production Expenses Mills Per Net KWH Labor	Fuel	Other	Total
Minn.—37	Jackson	4920	16478	4.5	38	68	37	85	10325	10580	28074	3367	3053	1.99	4.60	.54	7.13
N. Mex.—23	Lovington	20030	63483	3.13	36	81	19	76	10126	4442	51672	721	2313	.89	2.44	.39	3.72

From left to right—William H. Reed, Head Internal Combustion Plants Section, REA; Howard Clutts, diesel member Program Committee for the Conference accepting the Division B Award on behalf of R. B. Moore of the Lea County Electric Cooperative; Bruce W. Wadman, DIESEL PROGRESS; Marvin J. Johnson, Assistant Manager of Federated Rural Electric Association and Robert R. Staten, Chief Engineer of the Jackson Plant accepting award for Division A.

L[illegible], R. B. Moore, General Manager, right, Clyde R. Price, Superintendent of electric operations of the Lovington, New Mexico plant, holding the DIESEL PROGRESS bronze plaque as they posed in their main office at Lovington. Note their pleased, not to mention proud expressions.

JACKSON – MINNESOTA*

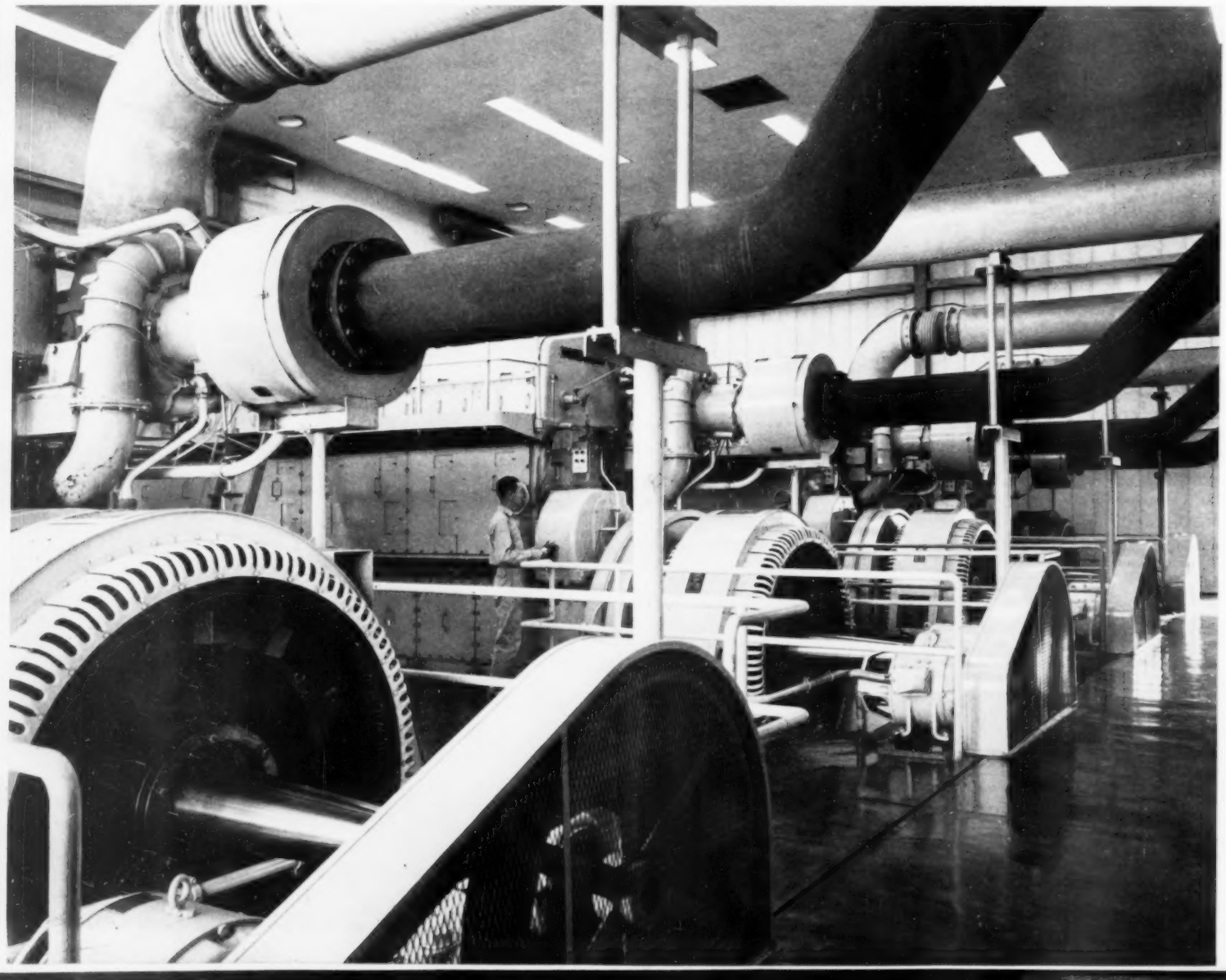
The REA 1957 Efficiency Award for Division "A" Is Won by Minnesota 37

SOUND management, experienced operators and efficient plant equipment form the combination that brought Jackson, Minnesota the 1957 DIESEL PROGRESS, Division A, REA Award. Owned by the Federated Rural Electric Association, Jackson has a generating capacity of 4920 kw and adjusted production cost in 1957 was 6.54 mills/kwh. Federated Rural Electric was organized in 1935 within a few months after the REA was authorized by Congress. It operated solely as a distribution cooperative until 1949 when construction of the generating plant was begun. Minnesota 37–Jackson went into operation in July 1950 with three 1750 hp Nordberg Duafuel engines driving 1230 net kw Elliott generators. A fourth unit, identical to the other three, was added in 1952 and brought the plant to its present capacity of 7000 hp, 4920 kw.

Each of the four Nordberg engines had more than 30,000 hours of operating time at the close of 1957. They are four-cycle, supercharged Duafuel engines with eight cylinders of 16" bore and 22" stroke. They develop their 1750 hp at 327 rpm and are equipped with exhaust gas driven Elliott turbochargers. Auxiliary equipment is installed in a large open basement on a unitized basis, ie. each engine with its auxiliaries forms a complete entity. During 1957, the four engines operated 19,822 hours and generated 16,477,900 gross kwh at a total cost (includes all charges and expenses) of 11.54 mills/kwh. Station service requirements averaged 4.58% for the year and the average running plant capacity was 67.4%. Total net production expenses amounted to only 7.132 mills/kwh and the adjusted cost for the contest (figured at 40¢ million BTU) brought the net production cost to 6.54 mills/kwh.

Federated used 167,214,000 cf of gas and 142,766 gallons of diesel fuel during the year. The gas had an average of 900 btu/cf and the fuel oil average was 137,593 btu/gal. The average fuel consumption including gas and oil for the year 1957 was 10,325 btu/kwh. During this same period the engines used 3247 gallons of lube oil for an average of 10,683 hp hrs/gal. Peak load during the year was 4100 kw. The load curve maintains a fairly consistent pattern throughout the year. December and January are the biggest months. Monday the biggest day and 10:00 A.M. and 6:00 P.M. he greatest demand hours. During the first two months of 1958 indicated peak loads climbed to

*This fine plant was first described in the July, 1952 issue of DIESEL PROGRESS, at which time only three of the Nordbergs were installed.



Winning performance was turned in by these four Nordberg supercharged Duafuel engines which drive Elliott generators in well-kept Jackson, Minnesota plant. Operator Eugene Lutz checks the Woodward Governor setting on #2 engine. Each of the identical engine-generator units is rated 1750 hp, 1230 kw at 327 rpm.

4200 kw and indications are that the Jackson plant is headed for another year of peak performance operation.

Responsible for this winning performance are a small, well knit group of enthusiastic men. Manager, Paul L. Ferguson was one of the founders of Federated Rural Electric and has planned and directed its activities from the start. It is now one of the largest electric cooperatives in the State and has a reputation for sound financial management. His assistant, Marvin J. Johnson joined Federated in 1942 and has the operation of the power plant as one of his major responsibilities. Plant Superintendent Robert R. Staten and Johnson work very closely in scheduling the production and preventive maintenance at the plant. They are also especially proud of the fact that the other five men on the staff are all qualified operators and maintenance men and all received their training on the job at the Jackson plant. The men rotate the assignments with three men on the operating shifts and two assigned to maintenance each month. Superintendent Staten keeps a close watch on the performance of each engine. The lube oil strainers are cleaned every 24 hours and indicator cards are taken on each cylinder after every 1000 hours of operation. The data obtained, plus the oil consumption figures, supply sufficient information on the condition of the rings, etc. Three of the engines still have the original rings (average liner wear, all engines, all cylinders is .005" total after 33,000 hours of operation). Crankshaft deflection readings and a complete crankcase inspection (including bearing clearances) is also made after every 1500 to 2000 hours. In addition, a very complete inspection is made annually. It includes valve clearances, crankpin, main and outboard bearing clearances, crankshaft deflection

Federated Rural Electric Association's modern plant is located on a large piece of high land, 1½ miles from the town of Jackson. The substation is just to the right. Four Maxim Silencers serve the Nordberg supercharged engines which won the Division A REA award for 1957.

The Winning Team (Left to Right) Wilbert Olson, Operator; Eugene Lutz, Operator; Victor E. Lundholm, Operator; Robert R. Staten, Superintendent; Marvin J. Johnson, Assistant Manager; Harry L. Moore, Operator; Robert A. Johnson, Operator.

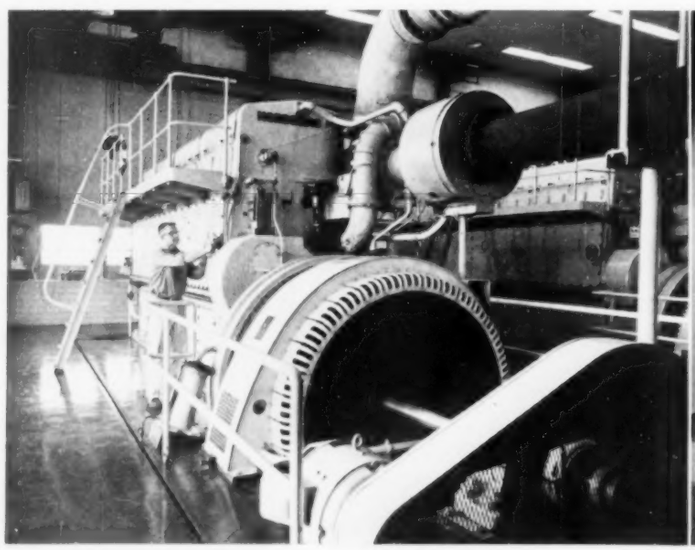
reading, liner wear, pump timing, firing pressures, exhaust temperatures, and all pressure and temperature alarms.

Outside the attractive brick plant there are two small brick buildings (gas pressure reducer house and well pump house), a shelter for the Young radiators, four 20,000 gallon diesel fuel oil storage tanks and a large warehouse/garage for the Coop's fleet of service trucks. A one story, brick office building is located at the Town of Jackson, 1¾ miles north of the power plant. The town is the county seat, has a population of approximately 4000 and maintains its own small electric generating plant. The power plant design and master plan were prepared by Pfeifer and Schultz, Consulting Engineers, Minneapolis, Minnesota. One of the features of the plant's design is the engine cooling water system. The radiators are enclosed in a shelter which has a louvered top and large sliding doors adjacent to the radiator cores. These various openings are adjusted to maintain above freezing temperatures in the shelter throughout the cold Minnesota winters. Jacket water from the engine flows through a thermostatically controlled 3-Way Fulton Sylphon mixing valve. There, a part of the 145° water is diverted to the radiator and the balance into the line from the radiator. The jacket water going to the Young vertical air radiator is cooled from 145° to about 120°. The required quantity of 120° water is blended with the 145° water at the mixing valve and is pumped through by an Allis-Chalmers jacket water pump, then through a Ross shell-and-tube jacket water heat exchanger where the lube oil is cooled and then into the engine for engine cooling. With this method the make-up water averages 85 gal. a day with a water treating cost of $23.00 a month.

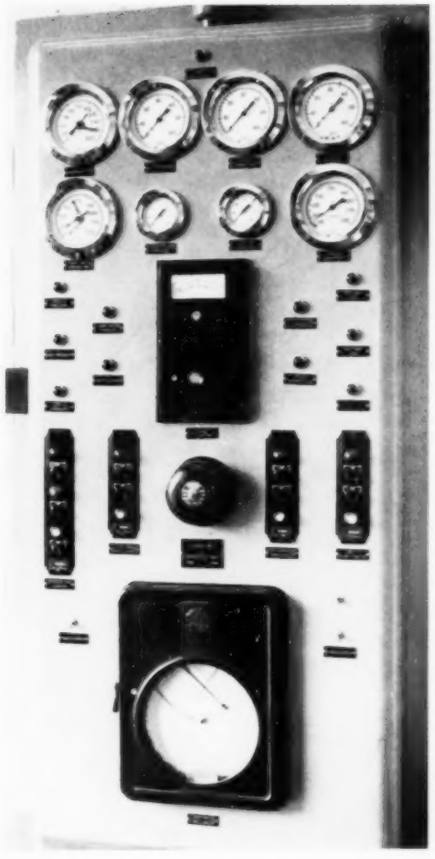
Federated Rural Electric has 2025 miles of line energized in Jackson and neighboring Martin County, both of which border the State of Iowa. Their revenue per mile of line per month has shown a steady increase and averaged $32.63 for the year 1957. The Coop's 4513 customers, used nearly 28 million kwh last year and this demand required that Federated purchase 15,702,300 kwh from outside sources. Federated REA is actually a member of the Cooperative Power Authority (CPA) which serves as the agent for 18 local REA's in southern Minnesota. Large blocks of power are purchased by CPA and this power, together with that amount generated by Jackson and one other plant at Benson, Minnesota, is made available to the member associations.

The Board of Directors of Federated REA is composed of an elected representative from each of six districts and one member at large. The current officers are: George H. Comstock, Pres., Rollo Campe, Vice-Pres. and George Moore, Sec.-Treas. The other Directors are Edwin J. Beckendorf, Edgar Ulbricht, H. C. Stenzil and Cecil Butler. Leo Winzenburg is the Association Attorney.

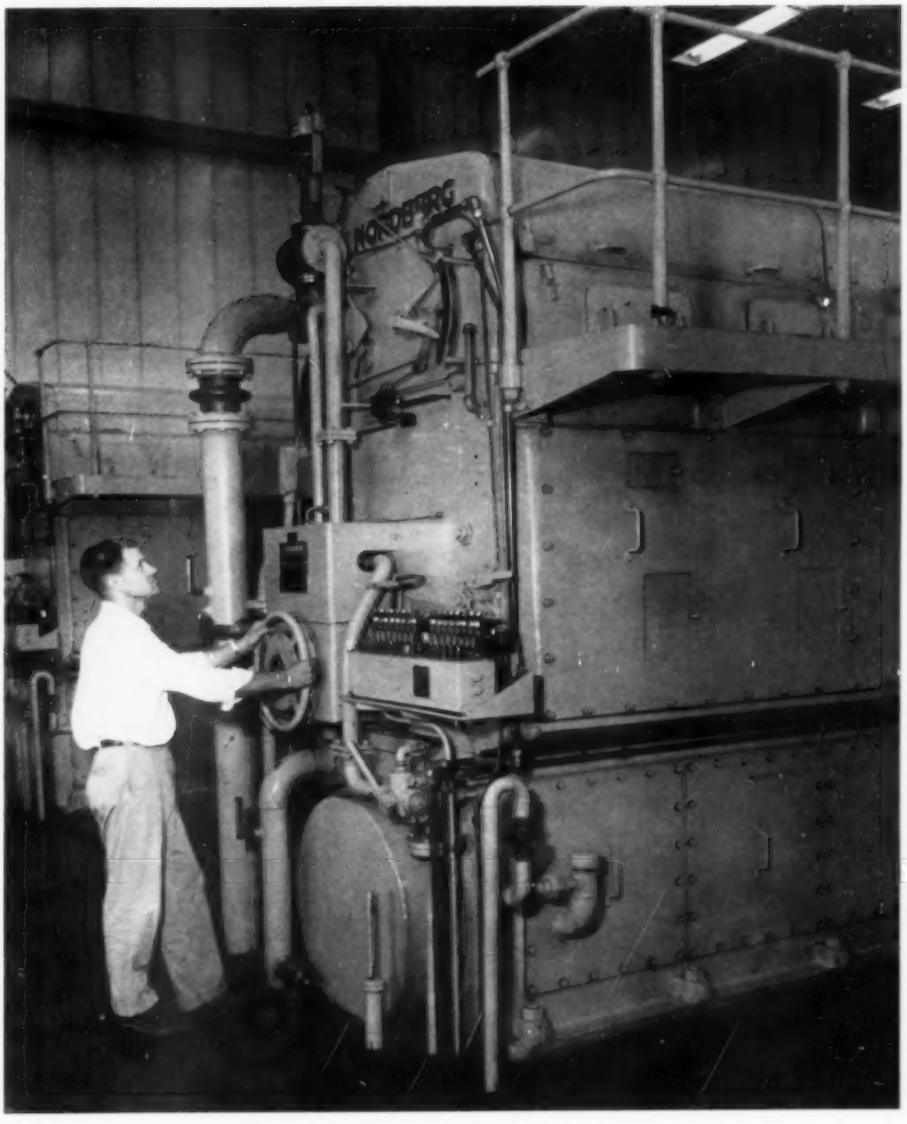
Operating side of #1 engine in award winning Jackson plant. Operator Harry "Bud" Moore adjusts the injection timing. Note Elliott generator. These turbocharged engines have eight cylinders of 16" bore and 22" stroke, are equipped with exhaust gas driven Elliott turbochargers and Woodward governors.



Starting air is stored in three Alpha tanks located in one corner of the basement. The main Quincy compressor is driven by a 10 hp GE motor and the standby unit has a four cylinder Wisconsin air-cooled engine. Operator Bob Johnson checks a pressure gauge located just below the Allen-Bradley control box.



One of four identical engine control and alarm panels. The Alnor Exhaust Pyrometer, Bailey Jacket Water Temp. Meter and Allen-Bradley push-button controls are prominent on the panel which was built by Diesel Service Co.



Operator Wilbert Olson on the control end of one of the four Nordberg four-cycle engines. The individual engine gauge boards are located along the wall (left). The wall in the background can be readily moved when an expansion of the plant is made. Note Mansel Lubricators in foreground.

Table of Principal Equipment

Engines	4 Nordberg Supercharged. Duafuel units rated 1750 hp at 327 rpm. 8 cylinders. 16"x22"
Generators & Exciters	Elliott
Turbochargers	Elliott
Governors	Woodward
Air Compressors	Quincy
Air Filters	Air Maze
Circulating water pumps	Allis-Chalmers
Fuel oil pumps	Roper
Fuel oil filters	Briggs
Fuel oil meters	Pittsburgh Equitable
Lube oil	Texaco
Radiators	Young Radiator
Switchboard	Westinghouse
Silencers	Maxim
Lubricating oil pumps	Roper
Lubricating oil filters	Briggs
Lubricating oil reclaimers	Hilliard
Gas meters	Pittsburgh Equitable
Pyrometer	Alnor
Lubricators	Manzel

LOVINGTON, NEW MEXICO*

Lea County Electric Coop. Two Cycle Diesel Plant Wins 1957 Efficiency Award. Lovington, New Mexico, Plant Receives Top Honor for Plants Over 5,000 kw. In DIESEL PROGRESS Contest: 7 Fairbanks-Morse, 2 Nordbergs Generate 63 Million kwh.

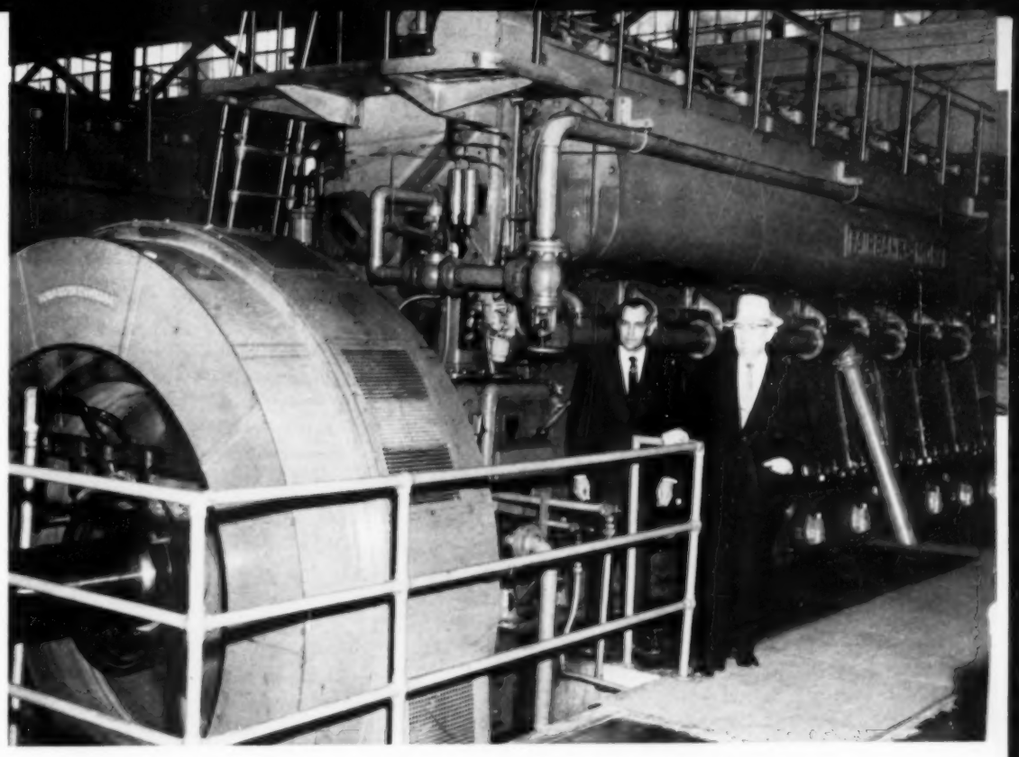
PRIZE-winning operating efficiency in the midst of a spectacular expansion program has been the achievement of the Lea County Electric Cooperative. The Lovington, New Mexico, plant has been judged the most economical big power producer of all REA-financed internal combustion plants in the nation in the 1957 DIESEL PROGRESS contest. In the year 1957, nine dual-fuel diesels in the Lovington plant produced a total of 63,483,400 kilowatt-hours at an average fuel cost of just 2.36 mills per kw hr. Total production expense, including supervision and engineering, station labor, fuel oil, fuel gas, lubricating oil, supplies and maintenance, was an impressive 3.717 mills per kw hr. Low fuel prices played a part in keeping costs down but this factor is equalized in the DIESEL PROGRESS contest and

Lea County's engineers and operators had to get top efficiency and economy from their seven Fairbanks-Morse and two Nordberg engines to win the award. The Lovington plant's achievement would have been notable under ideal operating conditions, but the full measure of accomplishment becomes apparent when it is noted that the plant increased its generating capacity by 66 percent during the prize-winning year. Of course, efficient operation in the midst of an expansion program has become a way of life for this power cooperative, striving constantly to meet the burgeoning requirements of a fast-developing area.

The Cooperative was organized in 1946 to bring electricity to the farms and ranches on 4,000 square miles of sparsely settled plateau in New Mexico and West Texas. To obtain a density that would make rural service feasible, the Co-op bought the power company's local system that served the little trading center of Lovington with its 1900 residents and the village of Tatum with a few more than 500 population. With the purchase came 150 miles of energized line and three small Fairbanks-Morse diesels with combined capacity of 730 kw. More important than the equipment, the Co-op acquired the power company's district manager, R. B. Moore, who has been Lea County's manager throughout the difficult development years. Mr. Moore planned an orderly, modest cultivation of his far-flung rural market, but his plough horse promptly became a runaway with the bit in its teeth. Farmers and ranchers wanted power not just for their homes but to run hundreds of irrigation pumps. In 1947, oil was discovered just north of Lovington and in 1949 and 1950, five more oil fields came in to the east of the town. The oil industry moved into Lovington to supply the new fields and to extend exploration. Irrigated farms increased the volume and value of their crops. Homes, schools, churches, stores were built to meet the needs of the growing population. Today, Lovington is a city of 12,000 inhabitants, one of the largest in eastern New Mexico. Lea County Electric Cooperative delivers electricity to 6,400 meters over a system that includes 2,250 miles of rural line. Service is given to 1,500 irrigation pumps and 900 oil wells; not to mention the home owners.

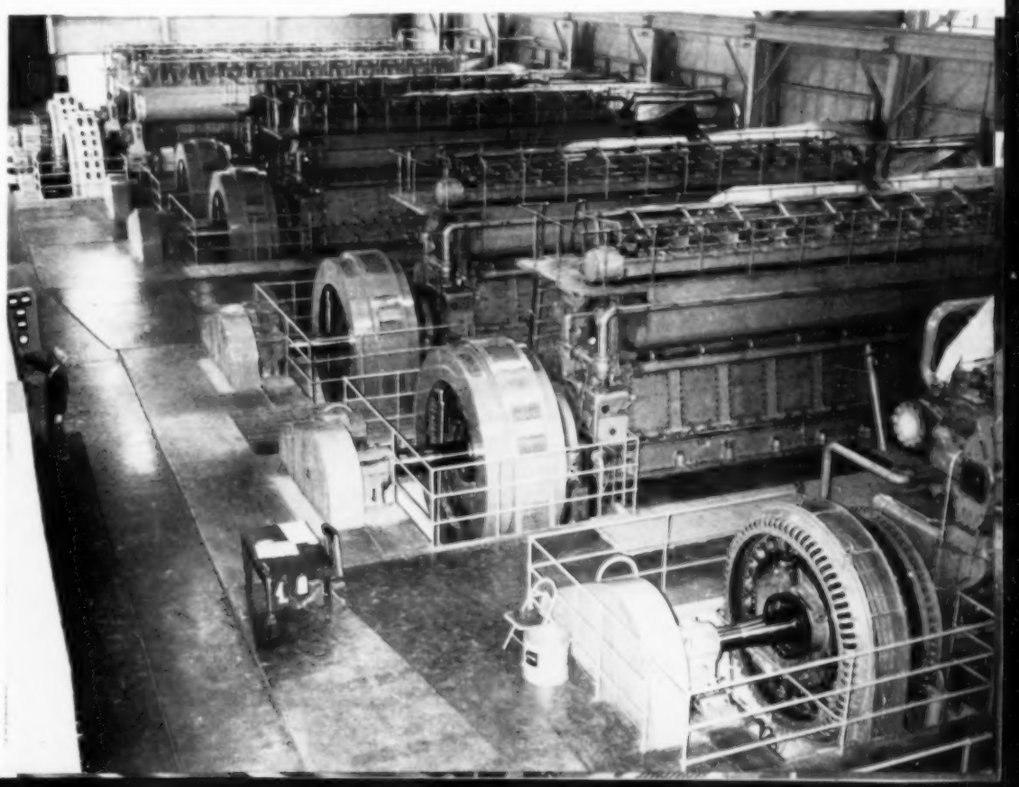
This service has been essential to the development of the area. Cooperation of town and country, farm and industry, has made the balanced progress possible. Without the concentrated population of the towns, Mr. Moore explains, it would have been impossible to carry power to the rural areas. The towns, in turn, subsist on the industry and agriculture in the field. To meet the skyrocketing demand, the power cooperative had to start virtually from scratch, for the old diesels acquired were too small to be more than a stop-gap. The co-op started actual operations in 1949 and immediately began to plan a new power station. In April, 1951, two model 33FD16 Fairbanks-Morse two cycle dual-fuel engines, normally rated at 1600 hp each, went into service in the new plant, followed by a third identical unit the next month. Each drives a 1010 kw alternator. (This and all subsequent kilowatt ratings will be given at Lovington's 3900-foot elevation.) This was only the beginning. In March, 1952, a 3500-hp model 31AD18 Fairbanks-Morse two cycle dual-fuel engine was put on the line. To this point, consulting engineers for the plant were Continental Engineering Co., with Clyde R. Price as project engineer. Mr. Price then joined the Lea County staff and was design engineer for the next three installations. These three units also were 3500-hp, Fairbanks-Morse two cycle dual-fuel diesels, each driving a 2250-kw alternator. One went into service in December, 1952, and the other two were put on the line in January, 1945. In a period of just 34 months, the plant had put in seven engines with combined capacity of 12,030 kw.

A study by the consulting engineers A. C. Kirkwood & Associates of Kansas City charted the anticipated expansion of power requirements for the years ahead and every indicator pointed up the necessity of greater generating capacity. The Kirkwood firm then designed the newest and largest addition to the Lovington plant's equipment. The new prime movers, which began substantial production in June 1957, were a pair of identical Nordberg two cycle duafuel engines normally rated at 5900 hp but derated at the 3900-ft alti-

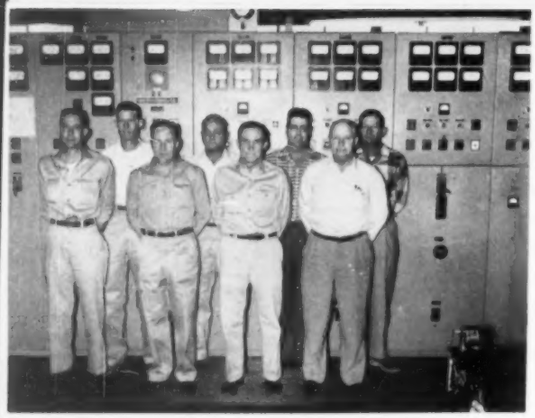


General Manager R. B. Moore (right) and Superintendent of Electric Operation Clyde R. Price inspect one of the seven Fairbanks-Morse engines in this plant.

This view of the Lovington plant shows seven of the nine dual fuel engines, five Fairbanks-Morse units and the two Nordbergs at the end of the line.



*The Lovington plant was first described in the December, 1951 issue of DIESEL PROGRESS.



Operating staff at the Lovington plant consists of: (l. to r. 1st row) Gilbert Ludecke, maintenance and operator, H. W. Harris, maintenance and operator, James Williams, assistant operator, and A. W. Haggerton, chief operator. (l. to r. 2nd row) Paul Wilcox, operator, H. H. Bevers, assistant operator, D. D. Hudgens, operator, and Jeff Monk, assistant operator.

tude to drive 5600 kw generators. These 12-cylinder engines have a 21½-in. bore and 31-in. stroke and operate at 240 rpm. This addition represented a 66 percent increase in plant capacity, raising the total to 20,030 kw. Peak loads in July and August were 13,300 kw, well above the previous capacity of the plant. Despite the constant pressure for expansion of plant facilities, the Lea County administrators and engineers built solidly and with an eye to the future. Prime movers were all efficient, heavy-duty engines designed for long-term, dependable service.

Naturally, the seven Fairbanks-Morse engines, in full service throughout 1957, generated the bulk of the power for the prize-winning year, 47,387,000 kw hrs or 74.65 percent of the total. The two Nordbergs made a substantial contribution, however, producing 16,096,400 kw hrs, virtually all of it in the last seven months. Table I gives detailed figures on production, fuel consumption, efficiency and economy for each of the nine engines. It will be seen that the little No. 1 unit, smallest producer in the plant, was both the efficiency and economy leader, turning out a kilowatt-hour on 9,728 BTU at a fuel cost of 2.21 mills. Following closely in efficiency was one of the plant's biggest engines, the Nordberg No. 9 unit, with 9,762 BTU per kw hr. Runners-up in economy were the No. 2, No. 5 and No. 7 units with average fuel costs of 2.31 mills per kw hr. It is evident that every engine in the plant was operating at excellent efficiency and economy levels. Table II gives itemized plant operating costs for the year.

To promote efficient production with a minimum of maintenance, it is the policy at the Lovington plant to operate engines at 80 to 85 percent loads. To show how carefully policy is translated into practice, average load for 1957 for the three small units was 83, 84 and 87 percent. Average for the four 2250-kw units was 82, 83, 84 and 85 percent. Since the year's figures included the break-in and adjustment period for the big engines, load averages were below the target but in later months were up around 80 percent. Timing of all engines are adjusted for maximum efficiency at the designated load levels.

Maintenance costs for the year were exceedingly low, a mere $3,033.99. Based on normal horsepower ratings, this represented a trifling 9.6 cents per installed horsepower for the year. If all the maintenance expense was charged to the seven older engines, average maintenance cost for the year was still just 16.1 cents per hp. This is a remarkable record for engines that have run from 10,669 to 50,199 hours, a combined total of 151,940 engine hours. Lea County's engineers keep close track of their equipment and its performance but they do not believe in overhauls unless conditions require them. A daily curve is kept on gas, pilot oil and lube consumption, so that engine efficiency can be checked at a glance. Any change for the worse is quickly noted and corrective action taken. Gas valve clearance is checked daily. Lubricating oil samples are analyzed in the plant and also are sent periodically to the oil company for more thorough examination. Lubrication has been excellent, lube consumption low. At present, lube oil is handled in drums, but it is planned to install bulk storage, both for operating convenience and economy. The 35 gravity pilot oil is trucked in and stored in tanks with combined capacity of 100,000 gal., then put through cellulose-packed filters and meters to individual engine day tanks. If, for any reason, fuel gas pressure should fail, an automatic device on each engine immediately switches the unit over to full oil operation. Should the pilot oil supply fail, the engine shuts down automatically.

Scavenging air for these two-cycle diesels is drawn through self-cleaning filters. The four 2250 kw F-M engines and the two 4000 Nordbergs are

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Operating Record 1957

Unit No.	(At 3900 ft) Kw Rating	Gross Kw Hrs	Fuel Consumed Gal. Oil	Fuel Consumed MCF Gas	BTU Per Kw Hr	Fuel Cost Kw Hr (Mills)
1	1010	1,302,600	5,806	12,616	9,728	2.21
2	1010	2,272,100	10,099	23,223	10,236	2.31
3	1010	2,539,100	11,342	26,124	10,295	2.32
4	2250	9,604,100	48,006	99,139	10,405	2.39
5	2250	10,608,600	51,703	105,992	10,074	2.31
6	2250	9,872,900	48,755	99,708	10,180	2.34
7	2250	11,187,600	53,160	112,629	10,127	2.31
8	4000	8,844,600	60,451	85,668	10,054	2.47
9	4000	7,251,800	56,499	67,002	9,762	2.49
Totals	20030	63,483,400	345,821	632,101	10,118	2.36

Table II—Lea County Electric Co-Op., 1957
Cost Computation of *Net* Energy Generated

Expense Items	Total Dollars	Mills per Kwh
Operation, Supervision & Engineering	$ 9,451.59	0.154
Station Labor	42,220.06	0.687
Fuel, Oil	35,976.43	0.585
Fuel, Gas	113,903.86	1.852
Lubricating Oil	16,239.50	0.264
Other Operating Exp. & Supplies	7,751.40	0.126
Maintenance	3,033.99	0.049
Total Production Expense	$228,576.83	3.717
Overhead Costs		
Depreciation	$109,506.27	
Taxes	16,862.28	
Interest	74,674.21	
Insurance	6,903.13	
Total Overhead Costs	$207,945.89	3.381
Total Production Cost	$436,522.72	7.098

Equipment Serving The Fairbanks-Morse Engines

Engines	(3) Model 33FD16, 1600 hp, 300 rpm, eight-cylinder, two-cycle, 16"x20" dual-fuel engines. Fairbanks, Morse. (4) Model 31AD18, 3500 hp, 277 rpm, ten-cylinder, two-cycle, 18"x27" dual-fuel engines. Fairbanks, Morse.
Alternators	(3) 1262-kva, 1010-kw, 3-phase, 60-cycle, 2400/4160-v, alternators, rated at 3900-ft elevation. Fairbanks, Morse. (4) Type TGZO, 3055-kva, 2250-kw, 3-phase 60-cycle, 2400/4160-v, .8 pf, alternators, rated at 3900-ft elevation. Fairbanks, Morse.
Governors	Woodward
Intercoolers	Marley
Heat exchangers	Ross
Lube oil coolers	Ross
Raw water cooling towers	Marley
Fuel oil meters	Rockwell
Natural gas temperature recorders	Bristol Co.
Gas meters and regulators	Rockwell
Before-and-after lube pumps	Roper
Scavenging air blowers	Roots-Connersville
Air intake filters	American Air Filter
Air intake silencers	Maxim
Exhaust pyrometers	Alnor
Gauges	Marshalltown
Air compressors	Gardner-Denver
Switchboard	Westinghouse Electric
Lube oil	Texaco Ursa X30**

served by motor-driven blowers, all with automatic vane control. Lovington temperatures range from an extreme low of 15 deg. to an extreme high of 105 deg. and the summer heat makes it desirable to route air from the blowers through water-cooled intercoolers. There is a separate jacket cooling system for each engine, complete with jacket and raw water pumps, induced-draft cooling tower, heat exchanger and thermostatic control valve. The towers are interconnected, however, for operating flexibility and maintenance convenience. Makeup water is drawn from deep wells and treated in a 120,000-gal. softener.

The plant's 16-panel switchboard is equipped with electrically-operated switch-gear and has three unusual features. First, it is a dual-type board, with voltage regulators, differential and over-current relays, watt-hour meters, volt meters, ammeters, kilovar meter, and alternator-temperature and neutral-ground indicators installed in the rear of the board. Second, it has all major circuits clearly traced on the front of the board, with contrasting colors identifying each circuit. The third feature is a roomy chamber built into the board, where maintenance men can work without being cramped. A 110-volt battery set supplied power for the electrically-operated switchgear and for emergency lighting. This is an isolated plant with no interconnections with other power systems and so every precaution was taken to arrange the plant's electrical system as well as the distribution system to insure continuity of service. There are two-way feeds into most of the area, particularly the towns, and if a line goes down, it takes only as long to restore service as it takes to get a man out to throw a switch. The plant itself is the dispatching center—operating 24 hours a day—and a service man is on his way as soon as instruments indicate an outage. All switches are numbered for quick and certain identification.

Mr. Moore recognizes that good equipment is valueless without good men to operate it and is justifiably proud of the fact that all but two of the plant operating staff have been there since the plant started. Working under Chief Operator A. W. Haggerton, there is an operator and an assistant for each shift, one maintenance man and a relief man. All are the product of the plant's own training school. Every operator is expected to know the entire plant but each man has specific assigned duties with no overlap or divided responsibilities. Monthly meetings are held to coordinate work of the plant and distribution crews, and to emphasize the never-ending safety program. General Manager R. B. Moore holds the reins and charts the course to be followed. He is cognizant, though, of the importance of highly-qualified executives in this growing utility. Clyde Price, with the title of Superintendent of Electric Operations, is a key man in the design and operation of the power facilities.

The elected trustees of the cooperative play an important role in policy making and are representative of the varied interests served by this power system. President Kyle Taylor of Maljamar, N. M., is a rancher. Vice-President Hubert Gill of Lovington is a farm machinery dealer. Secretary-Treasurer R. C. Willingham of Lovington owns a farm. Mrs. Ruth S. Patterson of Tatum, N. M., is a merchant. Grady Richards of Lovington is a petroleum products distributor. Tip Barnes of Crossroads, N. M., is engaged in ranching and oil field pumping. J. E. Wildman of Tatum runs a machine shop. L. L. Coats of Seminole, Texas, is a farmer and butane distributor. A. B. Carpenter of Plains, Texas, is engaged in farming and rentals. Marvin Powell of Lovington is a farmer and rancher. Lea County Electric Cooperative has been a major factor in the spectacular development of a large segment of the southwest. This is one utility that knows where it is going. In everything but rates, the direction is up.

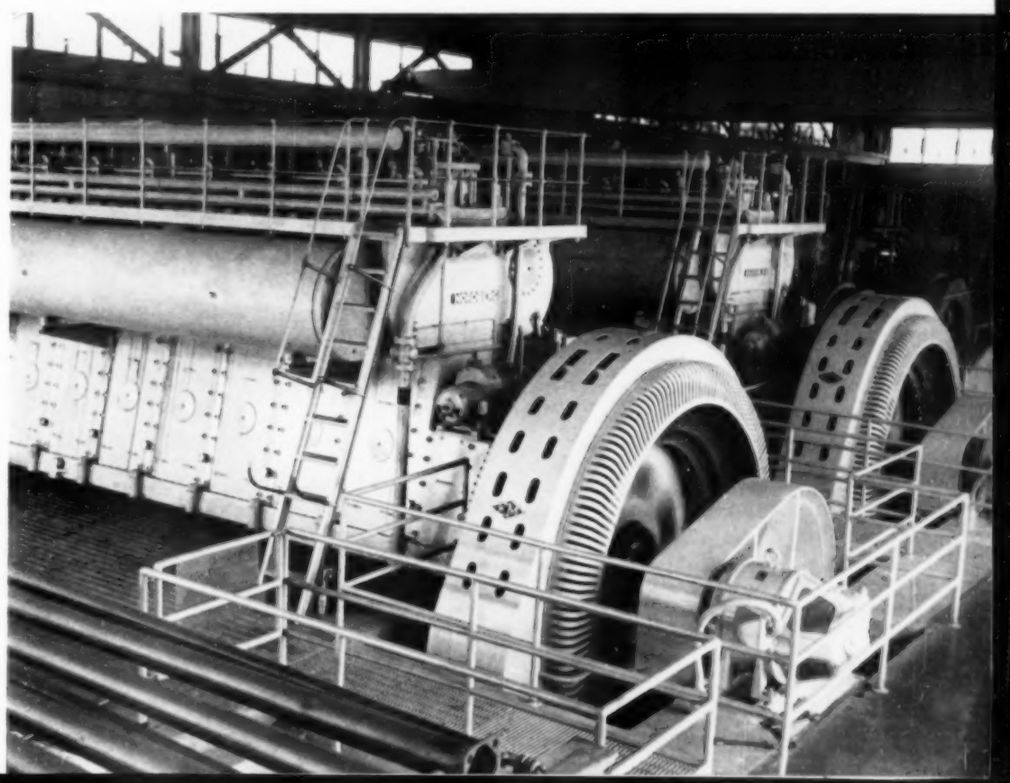
The Lovington, N. M., plant proves conclusively that the large efficient diesel station can be the answer for industry and municipalities seeking reduced power costs. This 20,000 kilowatt plant, operating at an 80% load, delivered more than 63 million kilowatt-hours at a total production expense of 3.717 mills per kw hr. Adding another 3.381 mills for depreciation, taxes, interest and insurance, the cooperative still got its power for just 7.098 mills. Even with higher fuel prices and higher interest rates, a city or industrial plant can make power at a substantial saving with efficient diesel engines. It is worth investigating.

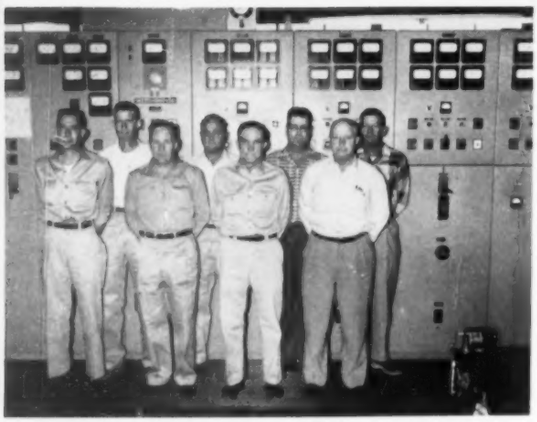
In the foreground are the American intake air filters and the Burgess exhaust snubbers serving the Nordberg engines. To the left are the similar filters and the Maxim exhaust silencers serving the Fairbanks-Morse engines.

Equipment Serving The Nordberg Engines

Engines	(2) Type TSGL 2112-31, 5600 hp, 240 rpm, Duafuel engines Nordberg
Alternators	(2) 4000 kw, 5625-kva, rated at 3900-ft elevation, 2400-4160 Y Electric Machinery
Exciters	(2) 60 kw, 250 volts, 1150 rpm Electric Machinery
Governor	Woodward
Blower	American Blower
Blower Motor	Electric Machinery
Engine and Blower Control Panel	Furnished by Nordberg
Exhaust Snubbers	Burgess-Manning
Air Filter	American Air Filter
Gas Meters	Rockwell
Pneumatic Controls	Bristol
Fuel Oil Meters	Empire-Rockwell
Lube Oil Cooler	Ross
Jacket Water Cooler	Ross
Main and Auxiliary Lube Oil Pumps	Roper
Fuel Oil Pump	DeLaval
Air Compressors	Gardner-Denver
Cooling Towers and Intercooler Water Towers	Marley
Switchboard and Substation	Westinghouse
Intercooler Radiators	Young Radiator

Newest and biggest engines in the Lovington plant are these two Nordberg duafuel units rated at 5600 hp at the 3900-ft altitude. They drive 4000 kw (net) Electric Machinery generators.





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Heat exchangers	Ross
Lube oil coolers	Ross
Raw water cooling towers	Marley
Fuel oil meters	Rockwell
Natural gas temperature recorders	Bristol Co.
Gas meters and regulators	Rockwell
Before-and-after lube pumps	Roper
Scavenging air blowers	Roots-Connersville
Air intake filters	American Air Filter
Air intake silencers	Maxim
Exhaust pyrometers	Alnor
Gauges	Marshalltown
Air compressors	Gardner-Denver
Switchboard	Westinghouse Electric
Lube oil	Texaco Ursa X30**

served by motor-driven blowers, all with automatic vane control. Lovington temperatures range from an extreme low of 15 deg. to an extreme high of 105 deg. and the summer heat makes it desirable to route air from the blowers through water-cooled intercoolers. There is a separate jacket cooling system for each engine, complete with jacket and raw water pumps, induced-draft cooling tower, heat exchanger and thermostatic control valve. The towers are interconnected, however, for operating flexibility and maintenance convenience. Makeup water is drawn from deep wells and treated in a 120,000-gal. softener.

The plant's 16-panel switchboard is equipped with electrically-operated switchgear and has three unusual features. First, it is a dual-type board, with voltage regulators, differential and over-current relays, watt-hour meters, volt meters, ammeters, kilovar meter, and alternator-temperature and neutral-ground indicators installed in the rear of the board. Second, it has all major circuits clearly traced on the front of the board, with contrasting colors identifying each circuit. The third feature is a roomy chamber built into the board, where maintenance men can work without being cramped. A 110-volt battery set supplied power for the electrically-operated switchgear and for emergency lighting. This is an isolated plant with no interconnections with other power systems and so every precaution was taken to arrange the plant's electrical system as well as the distribution system to insure continuity of service. There are two-way feeds into most of the area, particularly the towns, and if a line goes down, it takes only as long to restore service as it takes to get a man out to throw a switch. The plant itself is the dispatching center —operating 24 hours a day—and a service man is on his way as soon as instruments indicate an outage. All switches are numbered for quick and certain identification.

Mr. Moore recognizes that good equipment is valueless without good men to operate it and is justifiably proud of the fact that all but two of the plant operating staff have been there since the plant started. Working under Chief Operator A. W. Haggerton, there is an operator and an assistant for each shift, one maintenance man and a relief man. All are the product of the plant's own training school. Every operator is expected to know the entire plant but each man has specific assigned duties with no overlap or divided responsibilities. Monthly meetings are held to coordinate work of the plant and distribution crews, and to emphasize the never-ending safety program. General Manager R. B. Moore holds the reins and charts the course to be followed. He is cognizant, though, of the importance of highly-qualified executives in this growing utility. Clyde Price, with the title of Superintendent of Electric Operations, is a key man in the design and operation of the power facilities.

The elected trustees of the cooperative play an important role in policy making and are representative of the varied interests served by this power system. President Kyle Taylor of Maljamar, N. M., is a rancher. Vice-President Hubert Gill of Lovington is a farm machinery dealer. Secretary-Treasurer R. C. Willingham of Lovington owns a farm. Mrs. Ruth S. Patterson of Tatum, N. M., is a merchant. Grady Richards of Lovington is a petroleum products distributor. Tip Barnes of Crossroads, N. M., is engaged in ranching and oil field pumping. J. E. Wildman of Tatum runs a machine shop. L. L. Coats of Seminole, Texas, is a farmer and butane distributor. A. B. Carpenter of Plains, Texas, is engaged in farming and rentals. Marvin Powell of Lovington is a farmer and rancher. Lea County Electric Cooperative has been a major factor in the spectacular development of a large segment of the southwest. This is one utility that knows where it is going. In everything but rates, the direction is up.

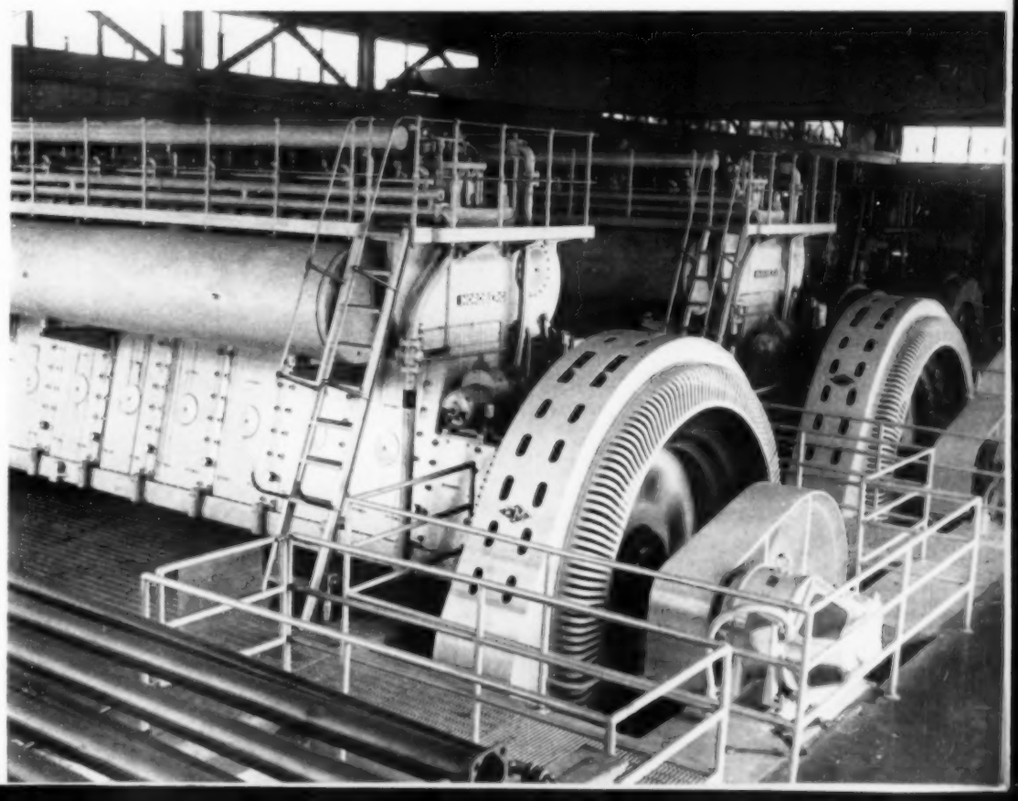
The Lovington, N. M., plant proves conclusively that the large efficient diesel station can be the answer for industry and *municipalities* seeking reduced power costs. This 20,000 kilowatt plant, operating at an 80% load, delivered more than 63 million kilowatt-hours at a total production expense of 3.717 mills per kw hr. Adding another 3.381 mills for depreciation, taxes, interest and insurance, the cooperative still got its power for just 7.098 mills. Even with higher fuel prices and higher interest rates, a city or industrial plant can make power at a substantial saving with efficient diesel engines. It is worth investigating.

In the foreground are the American intake air filters and the Burgess exhaust snubbers serving the Nordberg engines. To the left are the similar filters and the Maxim exhaust silencers serving the Fairbanks-Morse engines.

Equipment Serving The Nordberg Engines

Engines	(2) Type TSGL 2112-31, 5600 hp, 240 rpm, Duafuel engines Nordberg
Alternators	(2) 4000 kw, 5625-kva, rated at 3900-ft elevation, 2400/4160 Y Electric Machinery
Exciters	(2) 60 kw, 250 volts, 1150 rpm Electric Machinery
Governor	Woodward
Blower	American Blower
Blower Motor	Electric Machinery
Engine and Blower Control Panel	Furnished by Nordberg
Exhaust Snubbers	Burgess-Manning
Air Filter	American Air Filter
Gas Meters	Rockwell
Pneumatic Controls	Bristol
Fuel Oil Meters	Empire-Rockwell
Lube Oil Cooler	Ross
Jacket Water Cooler	Ross
Main and Auxiliary Lube Oil Pumps	Roper
Fuel Oil Pump	DeLaval
Air Compressors	Gardner-Denver
Cooling Towers and Intercooler Water Towers	Marley
Switchboard and Substation	Westinghouse
Intercooler Radiators	Young Radiator

Newest and biggest engines in the Lovington plant are these two Nordberg duafuel units rated at 5600 hp at the 3900-ft altitude. They drive 4000 kw (net) Electric Machinery generators.



THE HIGHLANDER

Reminds Us of the Good Old Days When Fine Yachts Like this—Well, Why Pine?

The beautifully-appointed deck lounge is finished in teak, has television, Hi-Fi radio and record player.

The Highlander off the Miami Beach shoreline.

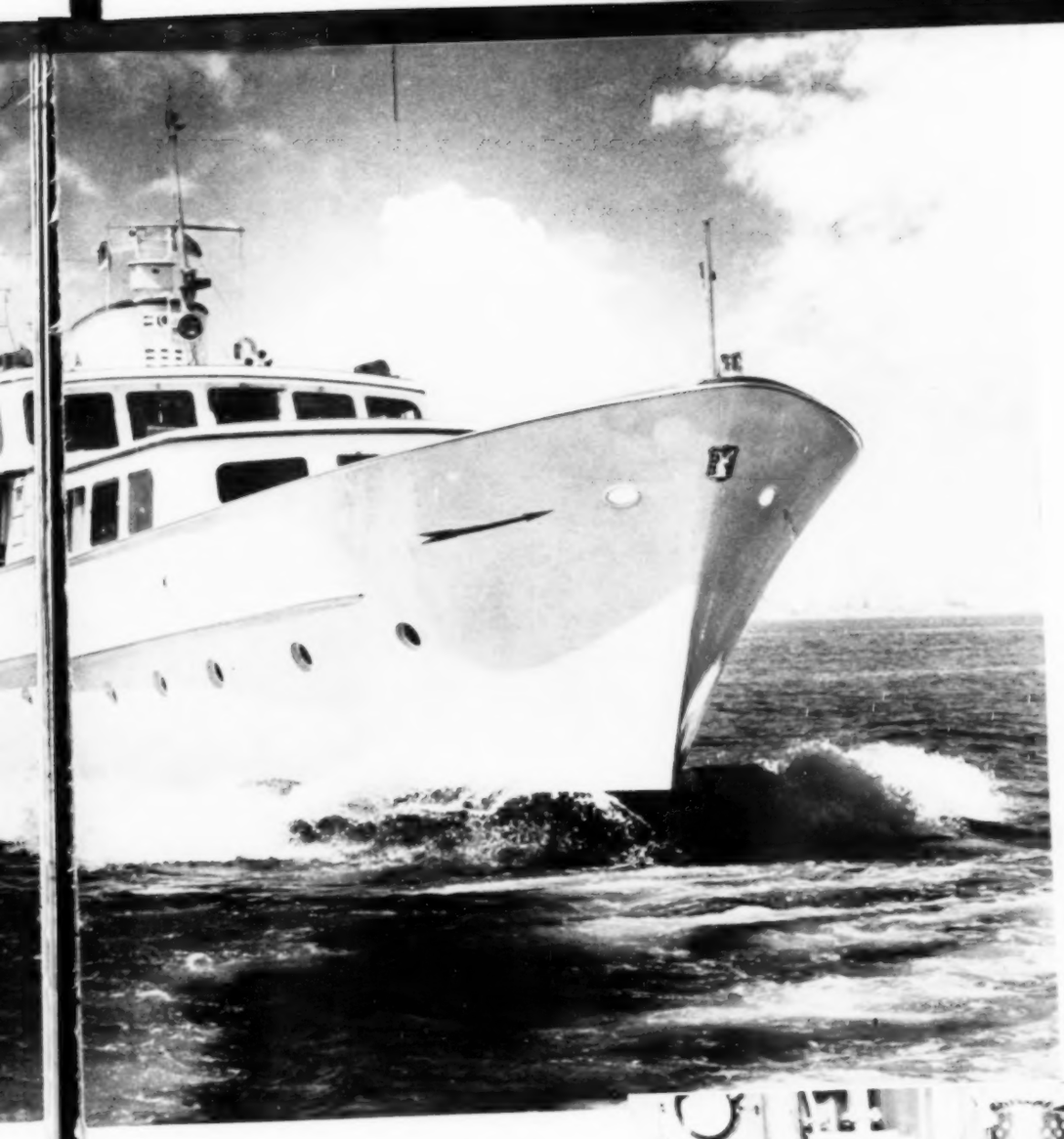
WHEN the sleek 100-foot sea beauty *The Highlander* casts off her lines at her summer berth on the Hudson at 79th Street in New York early this summer, she is bound to attract more than just casual attention. And well she may because this brand new cruiser, the largest to be commissioned so far this year, can well be included among the top luxury craft of the day. She is owned by Forbes, Inc., publishers of FORBES magazine and other business services. Flying the burgees of the New York Yacht Club, the Boca Raton Yacht Club and the Key Largo Anglers Club, she comes to New York waters from shakedown cruises off the coast of Florida and the Bahamas.

Designed by the well-known naval architect H. W. de Vooght and built by Feadship Holland, the craft is exceptionally seaworthy and manœuvrable. And according to her captain, Albert K. Sylvia of Martha's Vineyard, Massachusetts, she can be taken on extended ocean cruises or trips up the Hudson with equal ease and safety. The craft, which has a steel hull, a beam of 20′ and a draft of 6′, took 26 months to build with Captain Sylvia personally supervising most of the construction. Power is supplied by a pair of General Motors 6-110 diesel engines which give the large ship a top speed of 13 knots. The diesels turn 40″ x 32″ 3-blade propellers through 3 to 1 reduction gears. With fuel tankage slightly under 3,000 gallons, the craft has a cruising range of 1250 miles. Life aboard centers about a deck lounge 13′ x 16′, a dining salon 13′ x 13′, and an after deck 13′ x 10′ with Hi-Fi radio and music piped throughout. The deck lounge has a 21″ television set and telephone service is available to all parts of the ship.

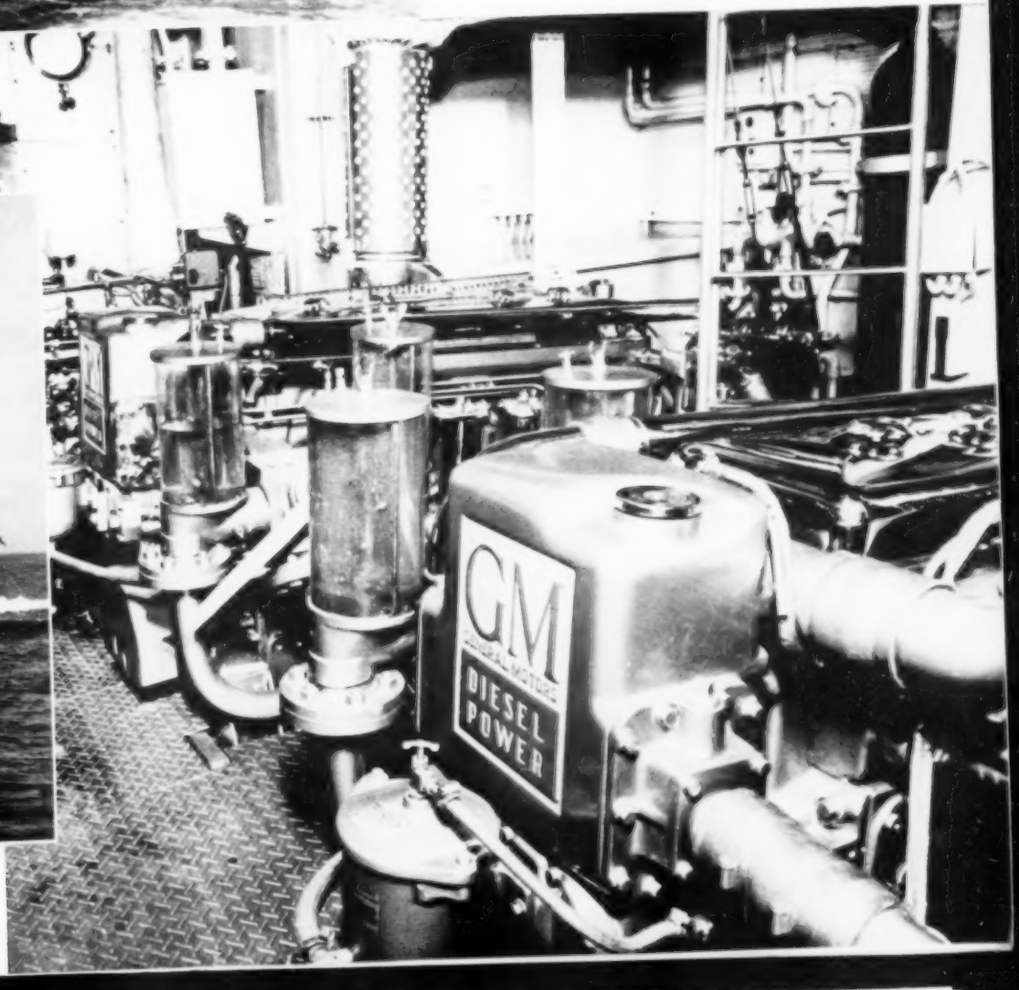
Owner and guest quarters, finished in mahogany, include three double cabins each equipped with bath and shower. Crew quarters include double and single staterooms for the captain and chief engineer, respectively, and a forecastle with four bunks. The galley is finished in formica and stainless steel and has two gas ranges operated with bottled gas, a 30 cu ft refrigerator, a 10 cu ft deep-freeze unit and a 48-tray ice maker. Service to the dining salon above is by dumb-waiter. The wheel house is constructed of aluminum and contains every possible aid to navigation and safety. This equipment includes Morse engine controls, RCA

radar, Sperry automatic pilot, Raytheon depth recorder, Wilford O. White depth sounder, RCA 85-watt radio telephone, RCA radio direction finder, compasses, windshield wipers, etc.

In addition to the diesels, which have a special paint and chrome finish, the engine compartment contains a 32-volt system for engine starting, a hot water heating system, two 10 kw generator sets charging batteries of 350 ampere hours capacity and 30 electric motors which operate salt and fresh water pumps, an air cooling system, radar, winches and other equipment. The ship carries two auxiliary boats, a Dyer 16' inboard and a 16' North Miami Fibercraft outboard, both of which can be launched at will for off-shore or special fishing trips. As an emergency device one of these craft carries a ship-to-shore telephone with a range of 150 miles. The entire ship is designed for utmost comfort under all weather conditions. Enclosed passageways connect the deck house, lounges and sleeping quarters. The after deck is open all the way around and is equipped with full-view storm curtains. The craft is to remain in New York and New England waters for this summer returning to Florida for the winter season.



The Highlander on shakedown cruise down South earlier this year.



Two General Motors 6-110 Diesel engines have special paint and chrome finish. They give the craft a top speed of 13 knots.

NEW FRACTURING BARGE

By W. L. BODE

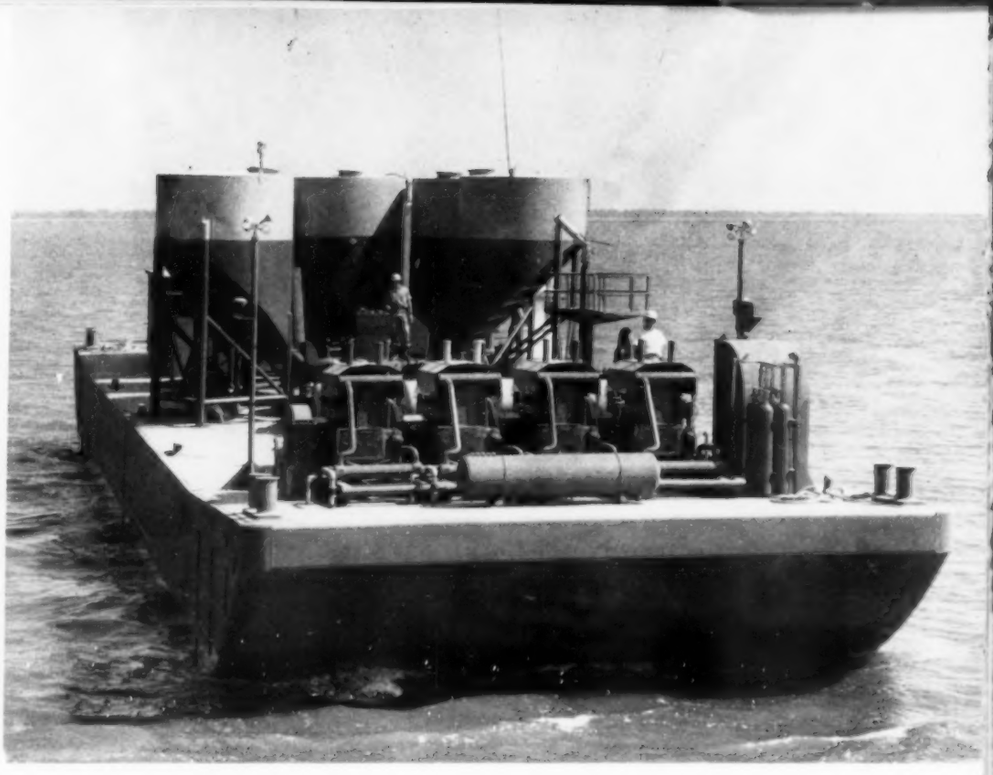
THE world's first oil well fracturing barge soon will go into service on Venezuela's Lake Maracaibo. Now being towed to South America from New Orleans, the 130-ft steel *Halliburton 808* is the first fracturing unit built for water locations. It will be used by Cia. Halliburton de Cementacion y Fomento, the Venezuelan subsidiary of Halliburton Oil Well Cementing Co.

Fracturing on Maracaibo basin wells was first applied in 1954 by Halliburton. Since then more than 200 wells have been treated and producers have indicated stepped-up fracturing programs for water locations. So far the lake wells have been fractured with trucks carried on barges. "Both the barge and its equipment were designed for the unusual assignment of fracturing wells at water locations," said Ralph R. Emery, Halliburton's vice president for foreign operations. "Based on an average 1500 sack fracturing job, the *808* will do the work of two fracturing trailers, a sand proportioner truck, six sand transports and probably a dozen oil transports that would be required for a comparable fracturing job on land. In addition, the *808* can perform at least two such fracturing treatments before returning to base."

Fracturing equipment aboard the *808* includes four Howco T-10 pumps, each powered by a 600 hp diesel engine; a sand proportioner for mixing fracturing fluids and sand; and a chemical agitator. All fracturing equipment, control consoles and storage for sand and chemicals are located on deck. Below deck the barge has storage for fracturing fluids, fresh water and diesel fuel. It carries 4,000 barrels of fracturing fluid, 3,850 sacks of sand, 15,800 gals. of diesel fuel and 6,000 gals. of fresh water. Air conditioned living quarters and galley are provided in a deckhouse.

The barge was built by Higgins, Inc., at its New Orleans shipyard. Fracturing and most auxiliary equipment for the *808* was shipped from Halliburton's Duncan, Okla., manufacturing plants and mounted on the barge at the service company's Harvey Canal docks across the Mississippi river from New Orleans. The principal particulars of the barge are: Length, 130 ft; Beam, 30 ft; Depth, at side amid ships, 10 ft 3 in.; Fracturing fluid, 4000 bbls; Fracturing sand, 3850 sacks; Diesel fuel, 15,800 gallons; Fresh water, 6,000 gallons; Load draft, 8 feet.

Below the deck and between the rake end bulkheads there are 3 main oil storage tanks, divided by a longitudinal swash bulkhead on the centerline. Above deck there is a deckhouse aft which is arranged to provide sleeping accommodations for two men, a toilet, shower and lavatory, a galley with electric refrigerator, air conditioner and surface cooking range. In forward half of the deckhouse there is a diesel driven air compressor, hot water heater and fresh water pressure set and a storage space for dry chemicals, tools, etc. In the March issue of DIESEL PROGRESS, pages 25, 26 & 27 we published a detailed article on oil well fracturing.



Shake-down cruise of *Halliburton 808*, world's first fracturing barge, is conducted in Louisiana waters. Built at New Orleans, the *808* is now being towed to Venezuela for use at Lake Maracaibo locations.

The machinery compartment in the forward rake end contains the following equipment:

Diesel	Caterpillar, D-311
Lube Oil Pumps	Marine Products
Air Compressor	Worthington
Aux. Generator	Onan 5 kw diesel

***Halliburton 808*, world's first fracturing barge. Built at New Orleans, the *808* is now in service in Venezuela on Lake Maracaibo. Ralph R. Emery, Halliburton Oil Well Cementing Co.'s vice president for foreign operations, said the barge's first fracturing treatment on a water location at Maracaibo will be early this year.**

WAUKESHA PROTECTS THE GATEWAY TO LATIN AMERICA

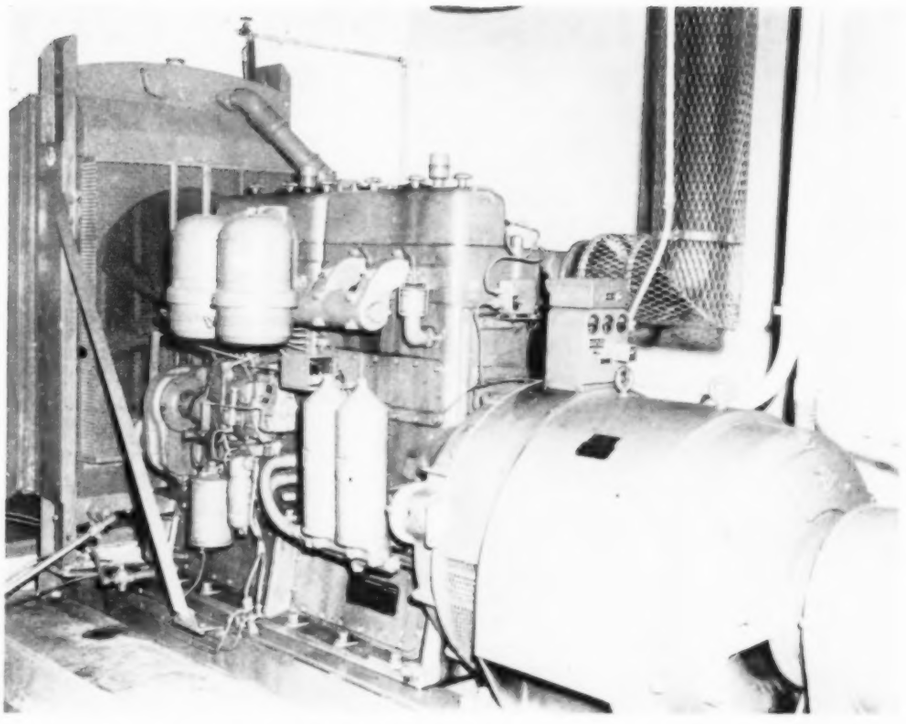
By ED DENNIS

MIAMI International Airport, Gateway to Latin America and the nation's busiest in plane movements, will be ready when the big jet airliners begin scheduled flights soon from its 9400 ft main runways. The Dade County Port Authority left nothing to chance in their long range planning of this International Airport at Miami, Florida. To assure themselves that hurricanes and other disasters would not disrupt the booming air traffic, the officials included in the airport planning, a fully automatic Waukesha diesel generator unit for standby duty.

The generator set is housed in a specially built hurricane proof C. B. S. structure out near the plane runways. In case of a power failure, this dieselized generating unit goes into operation in 11 seconds to provide lighting for the landing runways and taxiing strips plus the airport fire station and it stays on until 7 minutes after the regular power is restored. The model 6NKD Waukesha 4 cycle diesel engine has a bore and stroke of $7x8\frac{1}{4}$ in. which developes 209 hp at its governed speed of 1200 rpm. It has a piston displacement of 1905 cu in. and is naturally aspirated. It is a U. S. Electric Machinery package unit with a 150 kw 60 cycle 2400 volt Electric Machinery generator plus a 3 kw 125 volt dc exciter.

Equipment included with the diesel engine are 2 Winslow lubricating oil filters and 2 Donaldson air intake filters. The 24 volt starter and generator came from Delco Remy and the fuel oil pump and injectors were made by American Bosch. The unit was sold and installed under the supervision of J. Frank Knorr, Inc. of Miami, Florida. The fuel consumption of this standby unit is 7.5 gal per hr of #2 fuel oil. H. D. #20 lubricating oil is used. Power failures occur quite frequently and have been for as long as a two weeks duration. "It is always ready to take over in 11 seconds after a power failure", stated Mr. M. F. Holman. The plant provides electricity for approximately 1400 lamps. Two hundred of them are 200 watts the rest are 30 and 15 watt special pre-focused aviation type runway lights.

Miami International Airport, six times as large as New York's La Guardia, is made up of 1400 acres of rock sand and cement. It logs about 336,000 landings and take-offs a year and is soon to take its place as the number one airport of the nation. A factor in Miami's future as a jet air field is assumed due to the availability of space plus its 9,400 ft main runway and the excellent climatic conditions. The Port Authority's big ace for the future is the new 17 million dollar airport terminal construction program now going on. It too will have a special emergency standby dieselized generator set to assure the new terminal of electric power.



The 6 cyl model 6NKD Waukesha diesel engine showing the two Winslow lubricating oil filters and the two Donaldson air intake filters. Also shown is the American Bosch fuel oil injection pump. The diesel develops 209 hp while the Electric Machinery generator generates 150 kw. It was supplied by J. Frank Knorr, Inc. of Miami, Florida.

A section of the Miami International Airport the Gateway to Latin America. The field is made up of 1400 acres of rock, sand and cement. Take-off and landings reached about 336,000 last year. It is the largest in amount of international air cargo handled and the second largest in the nation for passengers. A plane lands or takes off every 84 seconds.

THE *ASA* FOR WEST FLORIDA

By ED DENNIS

THE *Asa* is the third and newest towboat in the marine fleet of A. P. Ward & Sons Inc. of Pensacola, Florida. It was designed and built for Gulf coastal and the inland waterways of the South by Bryant Boats Inc. of Bayou La Batre Alabama. This 64 foot, twin screw, vessel has adequate power, excellent maneuverability, which in addition to its trim compact design, should keep maintenance costs to a minimum. The main propulsion engines are two model Superior diesel engines each rated 650 hp at 900 rpm and built by White Motor Company, Diesel Engine Div.

This relatively young marine towing company, with offices in Pensacola, Florida, has grown rapidly in the 14 years since its founding. Starting in 1944 with a few oil barges and chartering tow boats when needed, its marine operation has grown to where *Asa* is now the third company owned towboat. The new vessel is named after the present owner's father who founded the firm and was Pensacola's leading citizen in the furtherance and promotion of the marine trade in that city. The two other vessels are the *Philip* a 500 hp dieselized tug which operates in the Birmingham Alabama area and the 800 hp *David* which presently is engaged in hauling jet fuel for the many air bases in the Pensacola area. The firm also operates other towing vessels and barges on a charter basis.

Since April 1957, when the *Asa* was first put into operation, the main use of this vessel has been running the Intra Coastal Waterway along Florida's panhandle from Louisiana to the St. Marks River, barging crude oil supplies for the City of Tallahassee's power plant. Faithfully, it has towed three 10,000 barrel barges to the city's power plant every 12 to 15 days. Built in the bayou country outside of Mobile, Alabama, this perfectly square and flat towboat performs ideally in the protected inland waterways service for which it was designed.

Two Superior, model 40 MX8, diesel engines provide propulsion. They are 8 cylinder heavy duty solid injection type with an $8\frac{1}{2}$ inch bore and a $10\frac{1}{2}$ inch stroke, with Elliott turbochargers. Each are rated 650 hp at 900 rpm and have a bmep of 120 psi. They are equipped with Snow Nabstedt reverse reduction gears of 2.97:1 ratio. The engines are direct reversing thereby making it unnecessary to stop the engines when reversing the vessels direction. Engine throttle and reverse gears are controlled from the pilot house. Two 30 kw Red Wing 120/208 volt generating units are used for lighting and auxiliary purposes.

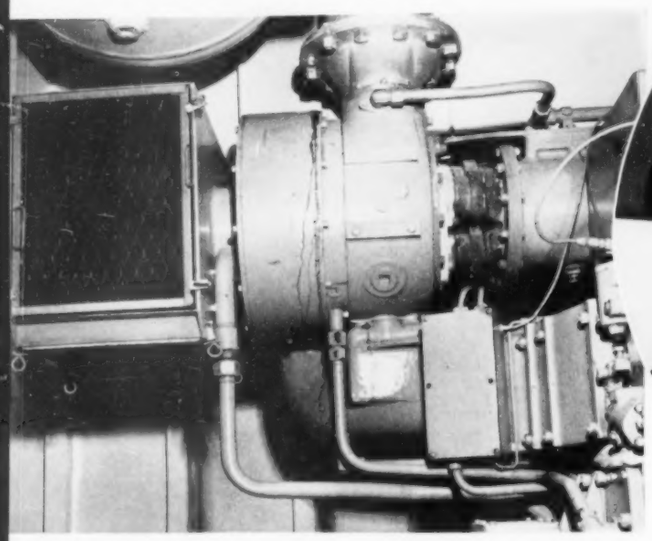
The fuel oil tanks, lying immediately fore and aft of the engine room, hold 15,000 gallons. The 500 gallon lube oil tanks are located along side the bulkhead with the oil circulation going through two Hilco Hyflow oil filters. Bilge pumps and a fire pump are all interconnected. Four Quincy air compressors provide the main air supply for engine starting and steering. These are augmented by two engine driven air compressors mounted directly on the Superior diesels and two electric driven compressors for the reversing operation. The machinery and electrical installations on the *Asa* are in keeping with the best in contemporary marine engineering practice.

After a number of months of operating at various speeds and with various size propellers, the diesels

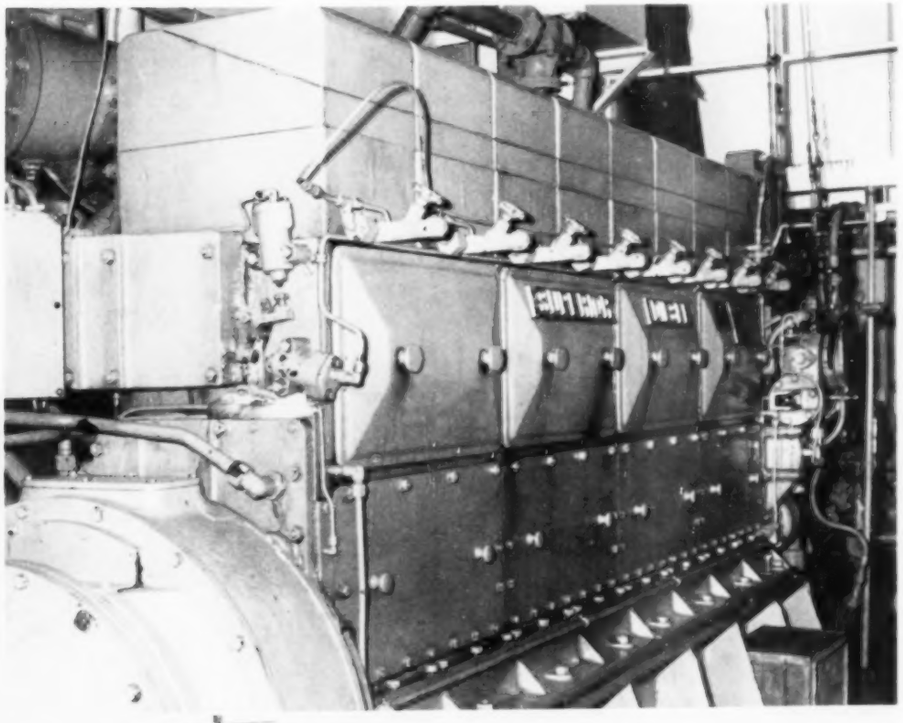
The 64x22 foot towboat *Asa* owned by A. P. Ward & Sons of Pensacola, Florida and constructed by Bryant Boats Inc. of Bayou La Batre Ala. operating free on the St. Marks River in the western section of Florida.

L to R: James A. Robbins, sales engineer White Diesel Engine Div. and relief captain Hagood Cardon of the *Asa* looking over DIESEL PROGRESS.

The Elliott turbocharger and the Air Maze type E air filter silencer.



The stern end of the 650 hp Superior diesel engine showing the 2.97:1 Snow Nabstedt r&r gears.



are now into a day to day operation at 780 rpm. Dropping the engines rated speed in combination with an increase in propeller pitch resulted in a fuel economy of 10 gph with only a slight drop in speed. Two propeller changes have been made by the owners since the *Asa* was launched. The opposite rotating 4 bladed Avondale stainless steel propellers were originally 60 in. x 48 in. With the diesels operating at 900 rpm and the propellers at 333 rpm, the fuel consumption for a number of trips ran about 65 gph including the unmeasured amounts for the auxiliaries. This was slightly under the manufacturers specified fuel consumption of .375 lbs/bhp-hr for their model 40 Superior diesels. Later the propellers were increased to a 51 in. pitch and the engine speed dropped to 850 rpm for a fuel consumption decrease to 58 gph. After several towing trips three more inches of pitch were put into the propellers and the engine speed again reduced. This time the fuel consumption dropped to 55 gph for both main engines. During these tests under actual operating conditions, the loss of speed with the tow has been only fractional.

Mr. Ward, the company's president, stated "I realize that we are probably increasing the bmep loading on the engines by this maneuver, but they give no evidence of being overloaded or of operating in a lugging condition and our exhaust is still clear. In as much as it has cut down our fuel consumption considerably, we are going to continue operating them this way." The pilot house which contains the usual navigational equipment except a steering wheel, is beautifully finished in natural mahogany plywood with awning type windows and insulated with 3 inches of rock wool. The *Asa* like almost all river vessels is maneuvered by means of steering handles that control the two steering and the two flanking rudders. Hydraulic indicators show rudder position and the rudders themselves are actuated by air rams. The wheelsman has complete control of the engines through a conventional pulley and cable arrangement that runs from the wheel house control pedestals to the engine room below. Pilot house engine instrumentation consists of two electric tachometers, lube oil and air pressure gauges, an R. C. A. 150 watt radio telephone and a Ratheon Pathfinder radar set mounted near the controls plus many other modern aids to navigation.

Living accommodations are provided for a crew of eight in heated and completely air conditioned mahogany paneled quarters. For crew comfort all exposed bulkheads are insulated with three inches of rock wool. The mess and lounge are attractively decorated. Since the *Asa*'s maiden trip, the Superiors have been virtually trouble free reported Mr. A. C. Colley, port captain and general manager.

"They have given us amazingly low oil consumption and our engine maintenance has been strictly routine, our troubles have been little ones". This new vessel will substantially add to the availability of towing power for A. P. Wards ever expanding towing and barging demands on the Gulf Intra Coastal Waterways. In the future as part of the long range vision and planning of this young marine firm, new dieselized equipment will be added to their modern fleet from time to time as needs arise.

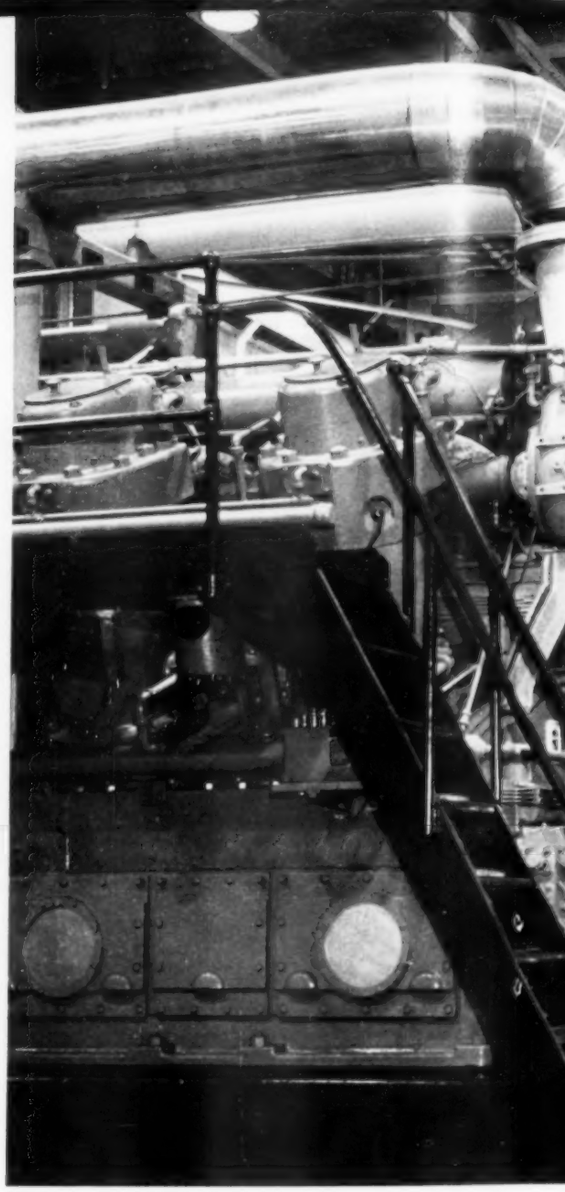
CANADA'S BIG INCH*

17 Compressors. Total 52,500 hp Power Canada's Big Inch Line

By JAMES JOSEPH

FORT St. John, British Columbia . . . six white plumes—exhausts from six Ingersoll-Rand 412 KVS gas-engine driven reciprocating compressors—finger into the sub-Arctic chill. Better than thermometers, those vertical, almost stagnant plumes say that it's cold outside. And it is—the mercury hovering at minus 35 degrees. But Westcoast Transmission Co. Ltd's Compressor Station #1, rising closeby the Alaska Highway, is winterized to take it. So are its three sister stations along the 650-mile, 30-inch pipeline—Canada's Big Inch—which taps British Columbia and Alberta gas fields.

In all, 17 heavy-duty compressors—a total 52,500 installated horsepower—route gas from far northern fields, deliver it to Huntingdon, B.C., near the U.S. border. At Huntingdon, Westcoast's $195 million Big Inch—operative only since October 1957—meters to three distribution companies, among them Pacific Northwest Pipeline Corp. (which serves some half dozen states, including Washington, Oregon and Colorado). Of Big Inch's initial 300MMcf daily gas capacity, Pacific is taking 225 MMcf/day. British Columbia Electric Co. Ltd. receives some 30 MMcf/day. Another 5 MMcf/day goes to Inland Natural Gas Co., Ltd., which distributes in eastern British Columbia. Thru its Pacific Northwest Pipeline link, Westcoast's gas—tapped more than 750 road miles north of the American border—hooks into El Paso Natural Gas's system, thus may eventually reach California consumers. Spaced at approximate 160 mile intervals along Canada's "Big Inch"—the Dominion's first major gas pipeline—stand four compressor stations:



Engine room . . . Compressor Station #1.

Parka-clad maintainer runs routine check on Station #1's American Air air intake and Maxim exhaust silencers, serving its six Ingersoll-Rand engines and compressors.

Compressor Station #1, the initiating station, rises athwart the Alaska Highway at Taylor, B.C., heart of Westcoast's new, $30 million industrial complex. Here British Columbia "sour" gas is "sweetened" (extracted of its by-products), compressed and sent toward the U.S. border. Station #1 houses six 2000 hp Ingersoll-Rand 412 KVS heavy-duty, direct-connected, turbocharged, 4-cycle, gas engine driven, 2-stage gas compressors.

Compressor Station #3, at Lake McLeod, some 90 miles north of Prince George, B.C., (and 150 pipe-

**Part II: Compressor Station #1—Part I appeared in the May issue on Compressor Station #3.*

line miles downstream from Station #1) has as its core four 3500 hp Nordberg high-pressure, supercharged, V-type FS-1316-HSC, four-cycle gas engines driving De Laval BLV-24x24 single-stage centrifugal compressors. Station has been operating at a compression ratio of from 1:20 to 1:35. Piping of the De Lavals, being 24 in., is looped between compressors.

Compressor Station #5—319 miles by pipeline downstream from the initiating station—likewise operates four 3500 hp Nordberg super-charged, V-type FS-1316-HSC, four-cycle gas engines driving 24x24 BLV De Laval centrifugal compressors . . . as in Station #3.

Compressor Station #7, 27 miles west of Kamloops, B.C. and closeby the Savona River, lies 484 pipeline miles below Station #1. Here work three 3500 hp Nordberg FS-1316-HSCs, driving De Laval BLV 24x24 centrifugal compressors. Nordbergs, as in all downstream stations, drive thru single-step speed-increasing gear.

As initiating station—and most northernly complex of its kind in all North America—Station #1 deserves special scrutiny. Essentially, two 26-inch suction headers pipe natural gas to the station's six compressors: (1) a 24-inch suction header carrying wet "sour" gas (a corrosive mixture of natural gas, H_2S, CO_2 and distillates) from British Columbia fields; (2) a 24-inch suction header gathering from Alberta's "sweet" gas fields.

Sour gas: sour gas, at about 36-degrees F, 410 psig, routes from British Columbia fields, processes thru two King Tool inlet scrubbers (where condensates are removed), flows to a 5 ft dia., 9 ft long knock-out drum (which flares—burns—hydrocarbons), thence to one end of the compressor station's 24-in. suction header. Fed by this header (via 12-inch laterals) are the 30-in. suction bottles on three of the station's six compressors (Compressors #4, #5 and #6). Compressed to about 840 psig, its temperature raised to some 117-degrees, sour gas leaves the compressors' 30-in. discharge bottles via a 10-in. lateral, then by a 24-in. discharge header is fed to nearby process plants (where sour gas is made to yield up elemental sulphur; and where butane, propane, motor and diesel fuels are processed from pipeline distillates). "Sweetened", the gas passes to two forced convection tube-type aftercoolers (Griscolm-Russell), thence thru outlet scrubbers (King Tool) before entering Westcoast's 650-mile transmission system.

Sweet gas: Alberta sweet gas, requiring no processing, enters the station compound at 475 psig, 28-degrees F—via a 26-in. suction header. Scrubbed thru three King Tool liquid separators (with total 200 MMcf/day operating capacity), sweet gas flows by 16-in. scrubber laterals to the station's 24-in. main suction header, thence by 12-in. laterals to suction bottles of three compressors (#1, #2 and #3). Compressor #4, tho currently compressing sour gas, is a "swing engine"—piped to handle either sour or sweet on demand. Discharging compressed to 810 psig, sweet gas routes via 10-in. laterals to the station's 24-in. discharge header, thence to the two King Tool aftercoolers. Entering the aftercoolers at about 167-degrees F., gas is dropped to 100-degrees before flowing thru outlet scrubbers (same size as suction scrubbers). Here, the 24-in. pipe becomes a 26-incher, spans the Peace River via a 1675-ft pipeline suspension bridge (longest of five along the system), finally hooks into the 30-in. mainline.

Compressor station: taking no chances, engineers winterized the plant, both inside and out: (1) all hot-water pipes, tho run inside the building, are jacketed in aluminum, the jackets packed with rockwool. (2) fuel-gas powering compressors is pre-warmed. Tapped from the 24-inch suction header, fuel gas passes to a Griscolm-Russell heater (which, thermostatically controlled, warms gas to 100° F). From the heater, gas routes to a 5 ft long, 18 in. dia. vertical surge tank. Out of the surge unit, gas (2000 CFM, 100 psig) flows to the engine fuel header. The 180-degree hot water (warming the fuel gas heater) comes from two dual-fueled (natural gas and propane) package boilers (each 2,500,000 btu/hr) supplying the station's 39 coil-fan heaters and jacketed piping. (3) four-bladed fans, housed in jackets insulating each engine's Maxim exhaust silencer, pull exhaust-heated fresh air into the building—taking some of the load off the heating system. (4) all liquid-carrying exterior piping is either (1) buried 6 to 9-ft underground (thus below the 3-ft frost level) or (b) steam-jacketed. (5) because water towers would freeze and burst—where temperatures plummet to minus 50—domestic and engine make-up water is likewise stored underground, the tanks buried beneath the station's heated garage. Make-up water comes from Westcoast's nearby steam plant. (6) engine cooling systems are protected by a 50% water-50% glycol anti-freeze mix. (7) provision's even made for pre-warming engine air—thru each engine's jacketed exhaust silencer. And, of course, only Arctic-type oil is carried in the American oil-bath intake air filters. (8) even lube oil storage and reconditioning units are housed out of the cold—in the station's basement. Among major tankage: a 2500-gallon lube-oil transfer tank, 2000-gallon clean-oil transfer vessel and 1200-gallon used-oil settling tank.

Engine room: essentially, the engine room is two-storied: the big Ingersoll-Rand gas-engine driven compressors (their four horizontal cylinders with a piston speed of 825 fpm) line the main floor. Engines have a bore of 15¼-in., a stroke of 18-in. Directly beneath them, in the basement, is located

most auxiliary equipment. So corrosive is sour gas that compressors handling it are equipped with special stainless steel rods. Regardless, all cylinders have a 15-in. stroke, a maximum working pressure of 1000 psig. Engines are installed with Elliott turbochargers (which forces air into intake manifolds at 4 psig). Each engine's unit control board monitors: (1) jacket water temperature; (2) manifold gas pressure; (3) manifold air pressure; (4) air filter motor; (5) lube oil temperature and pressure; (6) fuel gas pressure. An Alnor pyrometer gauges exhaust temperatures from each engine's 12 cylinders and turbocharger.

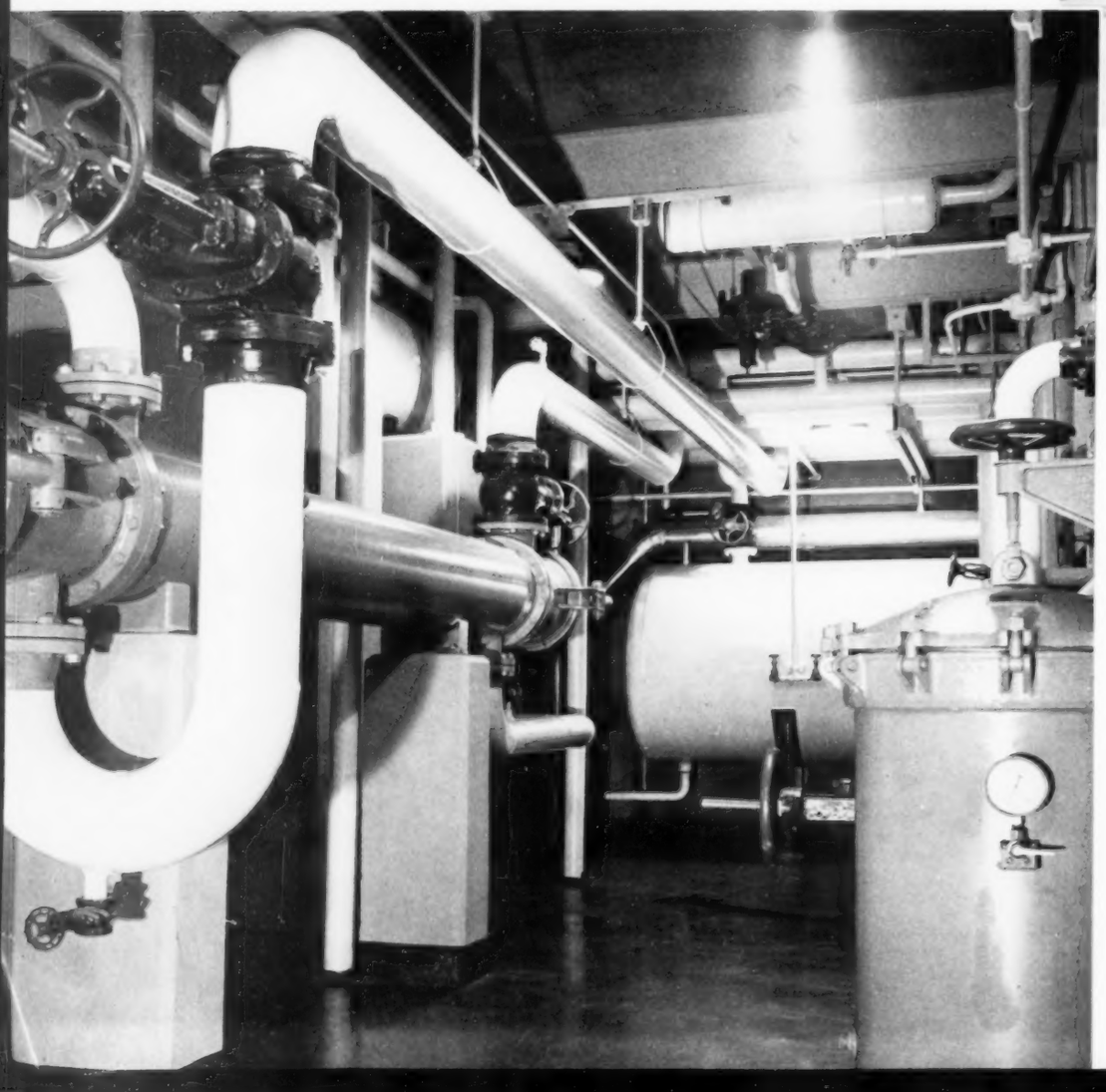
As an ironic reminder that this is the sub-Arctic, each board is also rigged with remote indicators and actuators—designed to open-close suction, discharge and bypass valves (without the operator donning a parka and braving the cold). The remote set-up, however, has been thwarted by freezing temperatures, this tho it's pressurized by 250 psi of air. Valves, outside the plant, freeze solid—must be manually operated.

"The sub-Arctic", says plant super Melvin Shannon dismally, "fouled the best laid plans. Those remotes? They just don't work." Alarm lights, on two unit engine boards, warn of too high a liquid (distillate) level in the process scrubbers—which feed sour gas to three of the engines. "If that light goes out," winces an operator, "we're in trouble."

Backing up the board are sniffers—corrosive gas detectors—worn at all times by at least one operator on duty. For H_2S can kill—and with the first lung-full.

Directly beneath engines—in the basement—are located (1) jacket water coolers, which drop 35-degrees from the 180-degree entering water; (2) lube oil coolers—which drop oil from an entering 160-degrees to a leaving 145-degrees; (3) lube oil filters, both full flow and sidestream; (4) and each engine's four 30-inch discharge bottles. Winterization decreed an all-under-one-roof design—the station's auxiliary area isolated from the engine room by a firewall.

Auxiliary Area: Two starting air-compressors (both Ingersoll-Rand 2-stage, belt-driven, 100 cfm at 250 psig) provide engine start-up. The main compressor is driven by a 30 hp GE motor. The standby is powered by natural-gas fueled Waukesha engine, model GUK, driving thru a Twin Disc clutch. Both compressors feed two starting-air receivers (3 ft dia. x 18 ft, 300 psig). Source of both utility and instrument air is a motor-driven (30 hp GE) Ingersoll-Rand compressor (2 stage, V-belt driven, 100 cfm, 100 psig) which feeds a utility air receiver (125 psig working pressure). Air from this vessel routes thru a Lectrodryer (dehumidifier) and, reduced to 60 psi, is held in an instrument air receiver.

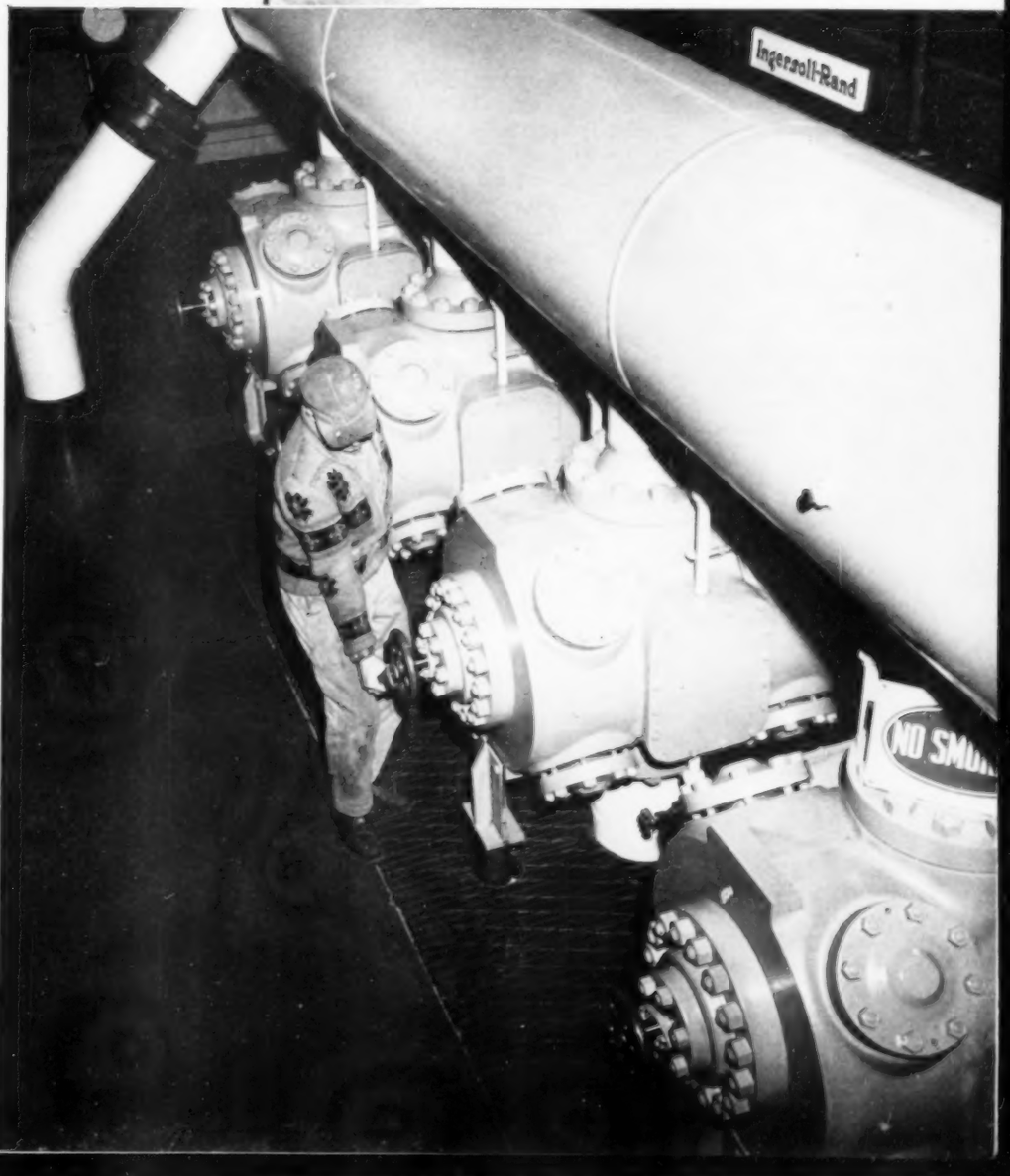


In basement, directly beneath engines they serve, stand jacket water coolers and lube oil filters . . . in this, perhaps North America's most built-for-winter compressor station. Note Commercial filter in foreground and Ross heat exchangers.

Equipment List

Compressor engines: Ingersoll-Rand
Compressor cylinders: Ingersoll-Rand
Turbochargers: Elliott (station #1)
Air Intake Filters: American Air Filter
Silencers: Maxim
Starting Air Compressors: Ingersoll-Rand
Starting Air Engine: Waukesha
Lube oil conditioner: Hoffman-Allan (all main engines); Hilco on auxiliaries.
Lube oil filters (sidestream): Commercial Filters
Lube oil filters (full flow): Nugent
Lube oil coolers: Ross
Jacket water coolers: Ross
Jacket water pumps: Ingersoll-Rand
Jacket water thermostat: Amot
Pumps: Ingersoll-Rand, Fairbanks-Morse, Roper, Corken, Canadian Ingersoll-Rand . . . De Laval.
Forced lubricators: Manzel
Unit control Panels: Ingersoll-Rand (station #1)

Framed by pipe, Compressor Station #1 rises in the sub-Arctic cold along Alaska Highway, backgrounded by industrial hub grown up around this, the initiating station on Westcoast Transmission's 650-mile, 30-inch Big Inch.



Compressor end . . . of big Ingersoll-Rand gas-engine driven compressors . . . at Compressor Station #1.

Roof Run-Off: Among the station's more interesting winterization features are its roof drains. Arranged along the low side of the compressor building's built-up roof (the slope: 14-ft in 42-ft) are eight drains, spaced on 12-foot centers, and installed inside the building, just under the roof. Installed inside, too, are the drains' 4-in. dia. cast iron vertical runs which drop from the roof, continue thru the basement and don't tie into 12-inch storm sewer lines until they're well below possible frost level. Edging the station's roof—and downslope from its eight drains—rises a 3-ft high, 10-inch thick concrete parapet. Its purpose: to act as a kind of snow fence, collecting drifting snow which, warmed by the roof, melts and flows to the drains. As for those six white plumes—exhausts from the Ingersoll-Rand compressor engines—which finger stagnantly into the sub-Arctic chill? Louder than words—or even thermometers—they say that it's cold outside. And here, along the Alaska Highway, it is certainly a fact.

OLIVER SHOWS ALL-DIESEL LINE

Both Wheel and Track Tractors, Combined Harvester and Orchard Sprayer Models Are Aimed at Global Sales-Service

By F. HAL HIGGINS

OLIVER corporation is aiming at world-wide sales in 1958. With its full lines of farm and industrial wheel and crawler tractors, farm and dirt-moving equipment lines up and before experts from its nine factories, the Oliver Corporation gave its California sales and service personnel a view of the Oliver offerings for 1958. This day's show and study for Oliver men at Gilroy, Calif., dramatized both the diesel coverage in all its wheel and track model tractors as well as in a diesel powered combined harvester and an orchard sprayer. The two bigger wheel tractors are powered by G-M engines, while the Hercules line that has appeared in the old Cletrac crawlers before Oliver acquired this firm at end of World War II is the diesel line of engines powering Oliver Corporation's crawler tractors, a combined harvester and a sprayer.

The diesel line-up I saw at Gilroy this year was: Wheel tractor models 550, 770, 880, 950, 990 and 995. Crawler tractors models OC-4, OC-6, OC-12, OC-15 and OC-18. Orchard sprayer #500. Combine harvesters #40 grain combine, and #40 Row Crop combine. Advertising and Sales Promotion Manager Dinnsen claims that Oliver is the only U.S. company to offer diesels in its entire wheel and crawler tractor lines. Also, he claims, it is the first U.S. manufacturer to offer a diesel combine or an orchard sprayer with this economical power. Oliver claims to be the only U.S. manufacturer building crawler tractors in Australia, a recent move of this old firm to go global in sales and service. Further, all of the diesel engines used in Oliver tractors and farm machines sold in Australia and Europe are American-made engines.

A tour of the Be-Ge plant at Gilroy was the first thing on the Oliver program. Visitors noted that while there was a light work force in the Be-Ge scraper plants at present, there was activity in other areas where guided missile parts are being made for the Government. Western Branch Manager George Blow opened the program with introduction of Be-Ge plant manager D. V. Stout. Officials and engineers from seven Oliver plants at Shelbyville, Ill.; Cleveland, Ohio; Gilroy, Springfield, Ohio; Charles City, Iowa; South Bend, Ind., and York, Pa., mounted the rostrum and went into details of the 1958 models from their respective factories. The histories of these famous old root companies that pioneered pick-up hay balers, crawler tractors, gas wheel tractors, plows, potato machines and sprayers were briefed as each touched the geneologies that have over the past quarter century coalesced to form the great Oliver Corporation of today. Some like Oliver Plow Co. and Farquhar go back more than a century to the very foundation of the U.S.'s great uplift via farm mechanization. The old Hart-Parr tractor compelled the big change-over of the tractor industry from steam to gas tractors soon after the turn of the century.

"Tritt" H. W. Tittito, veteran sales engineer for Oliver with over a quarter century in Cletrac and Oliver crawler sales in the West, went over the new OC-4 diesel. It has the GM Delco-Remy electric system. Oliver gives U.S. farmers choice of diesel, gas, LP gas and natural gas on many of its small wheel tractors and its stationary engines. The company rates its little crawler at 21.85 drawbar hp. The OC-15 that just came through the Nebraska Test with high flying colors got a lot of attention from both dealers and the Oliver engineers in their detailed lesson given those present.

A G.M. diesel powers Oliver's two biggest wheel tractor. Here the 990 is leveling land with a Be-Ge scraper from Oliver's California factory at Gilroy.

It carries both Donaldson and Purolator cleaners and has Bendix-Westinghouse starter.

The two big wheel tractors with GM diesels were high points for the dealer audience. They are aimed at western farmer and small contractor. The Oliver Super 99 GM diesel Tractor is avail-

Oliver is offering its full line of wheel tractors from 550 to 990 in gas, full diesel or LP gas engines to suit the demands of big or little farmers and industrial operators located in widely differing areas of the U.S. and export worlds. The Hercules diesels get the call on all the Oliver tractors up to the two bigger models. Here is an Oliver 880 on an ensilage harvester.

The Oliver 950 model with Hercules diesel on the plow for big farm work. Not only is Oliver offering its 1958 full line of both wheel and crawler tractors with diesels, but it is also the first U.S. manufacturer to offer a combined harvester and a sprayer with diesels. Hercules and G.M. are the diesel lines that power the Olivers, G.M. getting the call in the two bigger wheel tractors.

able with Allison torque converter. It carries GM's 371 diesel of 83 hp. It has six speeds, double disc differential brakes, Willard battery, Delco-Remy system and 3 Oliver cleaners. While dealers from various areas showed special attention to balers, sprayers, grain drills, manure spreaders, and the other lines from the seven factories outside of the Cleveland and Charles City plants were crawler and wheel tractors are built under the Oliver colors, it was the tractors that got everybody's complete attention. The old Miller rotary scraper has been re-engineered to make the idea quite practical for many types of land leveling by both farmers and small contractors in the West. I recall seeing one of these Miller scrapers in Arizona about 10 or 12 years ago when it was new. Even at that early stage, the idea looked good to both dealer and operator in the Arizona area. Oliver Be-Ge engineers are now building it in its modern style and it performs behind the big tired wheel Oliver diesels in speedy and impressive manner.

The Oliver show was nicely programmed. The fact that the company now has for its dealers a complete diesel line of both wheel and crawler tractors gives it the jump on U.S. competitors in diesel combines and spreaders sent the western sales and service personnel home with a lift that should spread the dark green colors of Oliver over a lot of the world of farm and dirt moving in the next few months.

BUCHI TELESCOPE VALVE SYSTEM FOR FOUR CYCLE ENGINES

AT the Oil & Gas Power Division Annual Conference* in Philadelphia Dr. Alfred J. Buchi** presented a paper on *The Buchi-Telescope-Valve-System on Four-Cycle Diesel Engines.* The highlights of this excellent paper are presented here.

Introduction

The Buchi-Telescope valve four-cycle internal combustion engine offers the advantage of a simple design, especially of the combustion cylinder head, the cylinder liner and the working pistons. The cylinder head castings also become simpler, as well as its manufacture. From the point of view of the working process the surfaces of the compression and the combustion space become smaller than in conventional engines and improve the starting conditions on account of smaller heat losses; this has also an advantageous effect on the whole heat cycle and on the heat balance and the fuel economy of the engine and assures a quiet running of the engine. The cylinders of all engines of any size can be scavenged to any desired degree demanded of their special purpose and working condition. No provisions like larger clearances, no cuts in the piston or specially shaped cams, etc., have to be applied. An effective swirl action in the cylinder space can be created and kept up during the whole scavenging and intake period. Therefore the fuel injection, distribution, atomizing and combustion will be greatly improved. Only relatively low fuel injection pressure is needed and, for the introduction of the fuel, large, preferably single-hole nozzles, not liable to choking through fuel deposits, can be utilized. All this improves the fuel consumption and ensures reliability of the fuel injection equipment and the engine. It may also be said, that the Buchi-telescope valve type internal combustion engine is characterized by its wholly symmetrical design with respect to the cylinder axis, and this ensures also symmetrical and uniform thermal and pressure stressing of all parts surrounding the cylinder with its head, piston and valve system.

To present this unique new development, we are using a number of illustrations and graphs and curves with captions below describing them in the following phase of the article. We hope that you, our readers, will find this presentation interesting.

Fig. 1

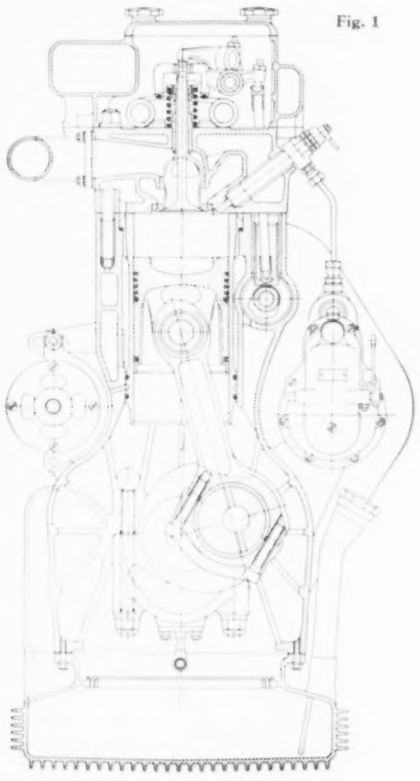


Figure 1 is a transverse section through the cylinder of a four-stroke cycle Buchi-telescope-valve type engine.

Fig. 2

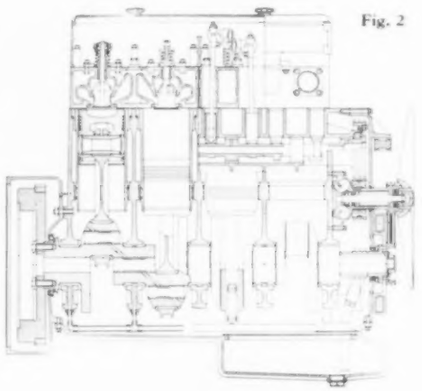


Figure 2 is a longitudinal section through the engine of Figure 1 taken partly along the center line of the crankshaft and partly along the center line of the camshaft showing the push rods for operation of the telescopically arranged valves. Due to the compact spring arrangement note the overall height above the wrist pin is small.

Fig. 3

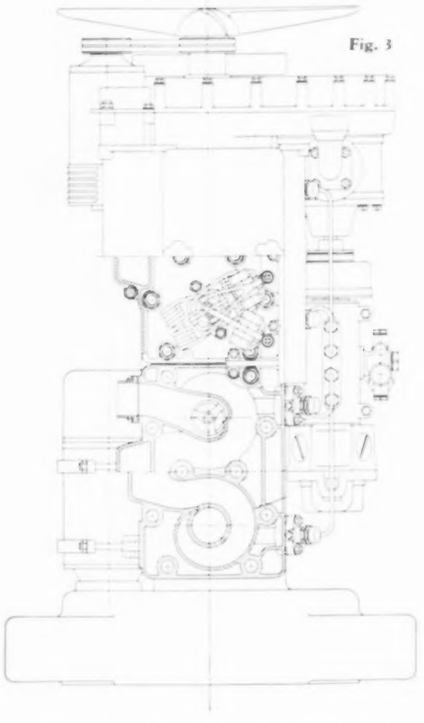


Figure 3 is a top view of the telescope valve type engine with one cylinder head cut through the spiral shaped air intake duct and another cylinder head cut through the exhaust duct. A top view of the cylinder head also shows the two rocker levers operating the intake and exhaust valves.

Fig. 4

Figure 4 is a photograph of the bell-shaped inlet and exhaust valve assembly. The inlet valve is at the outside while the exhaust valve is arranged to slide within the inlet valve.

Fig. 5

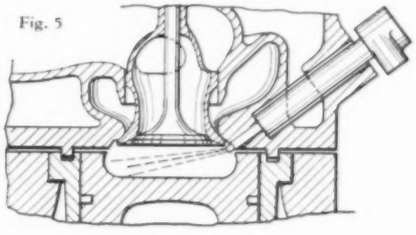


Figure 5 shows a section through the cylinder head, the combustion space and the piston of a telescope valve type engine and also shows the inlet and exhaust valve arrangement and the disposition of the fuel injector, while—

*of American Society of Mechanical Engineers, May 12-15, 1958.
**of Winterthur, Switzerland

Fig. 6

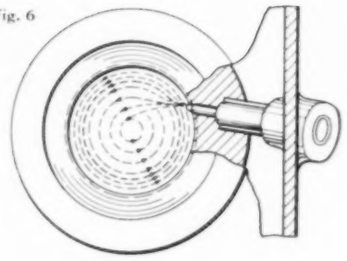


Figure 6 shows a top view of the symmetrically arranged combustion chamber in the piston. The arrows indicate the air rotation produced in the cylinder by the spiral inlet duct arrangement shown in Figure 3 and the direction of the fuel as it is injected into the combustion space.

Fig. 7

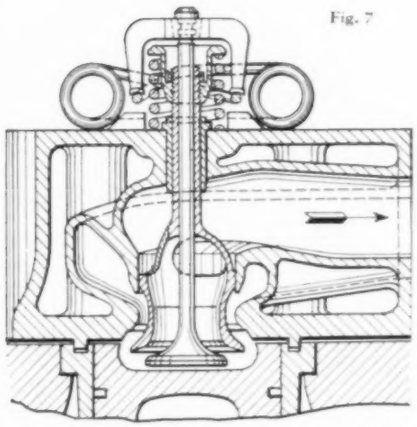


Fig. 8

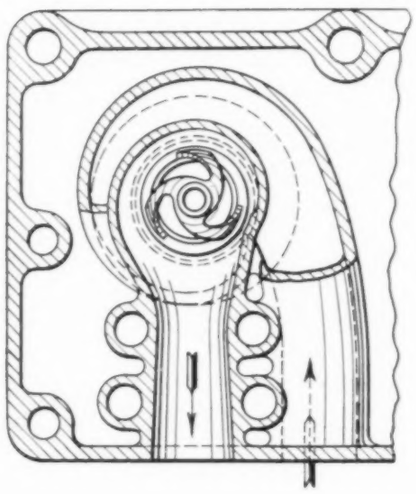


Figure 7 and *Figure 8* is a view of cross section through the cylinder head showing both the inlet (outer) and the exhaust (inner) valves in an open position. It should be noted that the valves and the walls of the combustion space are shaped such that passages of smooth configuration are formed to provide approximately constant flow areas for the scavenging air to pass from the inlet duct through the combustion chamber into the exhaust duct, as shown in Figure 8.

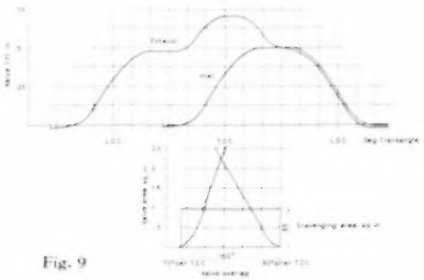


Fig. 9

Figure 9 shows the valve lift diagram of a telescope valve system and the flow area through the valves in function of the crank angle for a valve overlap angle of 118°. It represents the condition when the engine is supercharged with a mechanically driven compressor.

Fig. 10

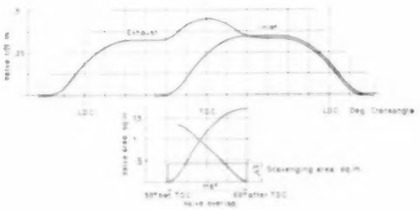


Figure 10 represents the valve timing, valve lift and flow area condition of a telescope valve type engine being supercharged by an exhaust turbocharger and having a scavenging angle or overlap of 160° crank. Note the exhaust valve closes against the inlet valve at a time the inlet valve is at its maximum travel, which is another reason for good performance.

Fig. 11

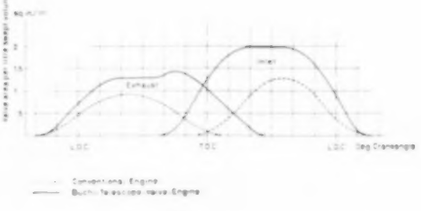


Figure 11 represents a comparison of the flow areas through the inlet and exhaust valve of a conventional engine (dotted line) and the telescope valve type engine (solid line). It can be seen that the maximum flow area through the inlet valve of a telescope valve system is 60% larger than the corresponding flow area of a conventional engine and the maximum flow area through the exhaust valve is 19% larger. The corresponding inlet velocity of the air charge is only 61.5% and the exhaust velocity, only 83% of the respective velocities encountered in conventional engines of equal size.

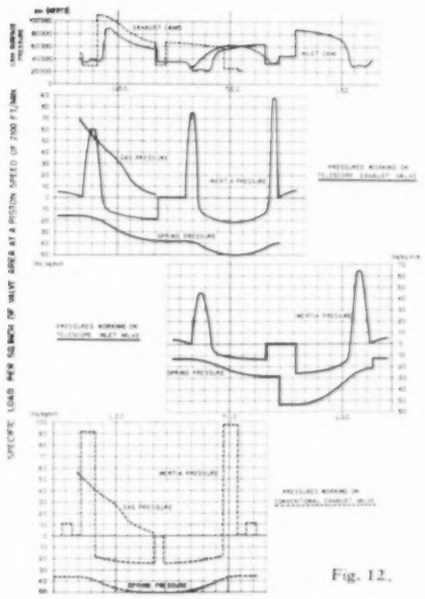


Fig. 12.

Figure 12 shows a comparison between a conventional and a telescope valve type engine of the pressures due to the gas pressure, inertia and spring pressure (Hertz) occurring at the cams as a function of the crank angle and at a piston speed of 2100 ft min. It is seen that in the case of the exhaust valves the highest cam pressures of the telescope valve engine are lower than those in the conventional engine. At the inlet cam, the pressures at their highest are approximately the same as those at the exhaust cam.

Fig. 13

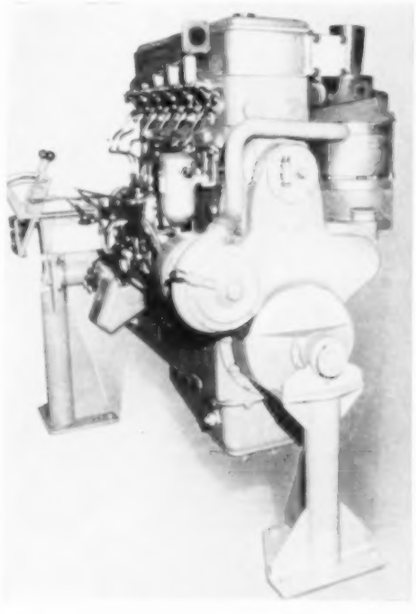


Figure 13 is a photograph of a 6 cylinder telescope valve engine on test. This engine has 4.33 in. bore and 5.90 in. stroke and rated speed of 1800 rpm and is the one used to produce the test data of Figs. 15, 16 & 17. Note the location of fuel injection nozzles on the left side and turbocharger on the right side.

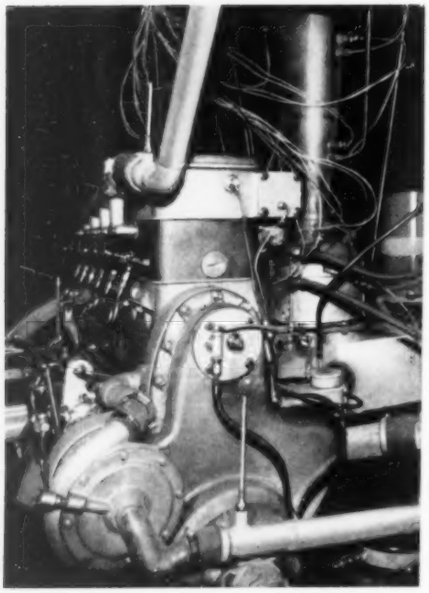


Fig. 14

Figure 14, Above is another view of a 6 cylinder telescope valve engine on test in Dr. Buchi's Laboratories.

Fig. 16

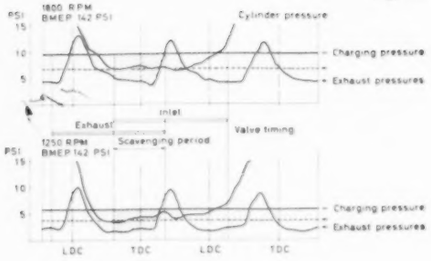


Figure 16 represents diagrams showing the cylinder pressure, exhaust gas pressure fluctuations before turbine, charging air pressure and mean exhaust pressure as a function of the crank angle for engine speeds of 1800 and 1250 rpm and bmep of 142 psi. The opening and closing points of the inlet and exhaust valves are indicated in the diagrams. It should be noted that the pressure shock after opening the exhaust valve diminishes in such a way that, when the inlet valve is opened, i.e. at the beginning of the scavenging, it has already fallen far lower than the charging pressure and consequently has a favorable influence on the scavenging effect. The pressure in the cylinder at its lowest is about the same height as the average exhaust back pressure.

Fig. 17

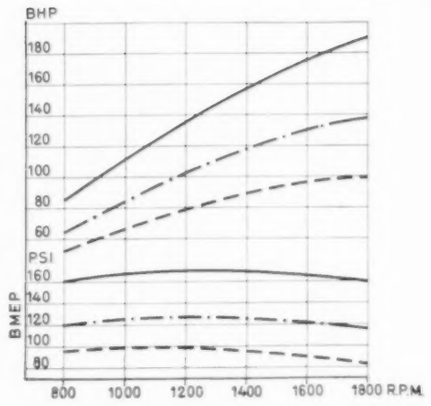


Figure 17 shows comparative test results of a conventional engine with atmospheric induction (broken line) the same engine turbocharged (chain-dotted line) and the Buchi telescope valve on the same engine turbocharged (solid line). It can be seen that the bmep of the Buchi telescope valve engine compared to that attainable in the same conventional non-turbocharged engine can be increased from 100 to 170 psi. At the maximum speed of 1800 rpm, the bhp is increased from 98 to 190 at the smoke limit. It is also well worth noting that, in comparison with the Buchi telescope valve engine with the turbocharged conventional engine, without any scavenging but only with a swirl action with masked inlet valves, the output could be raised from 136 to 190 bhp at 1800 rpm engine speed.

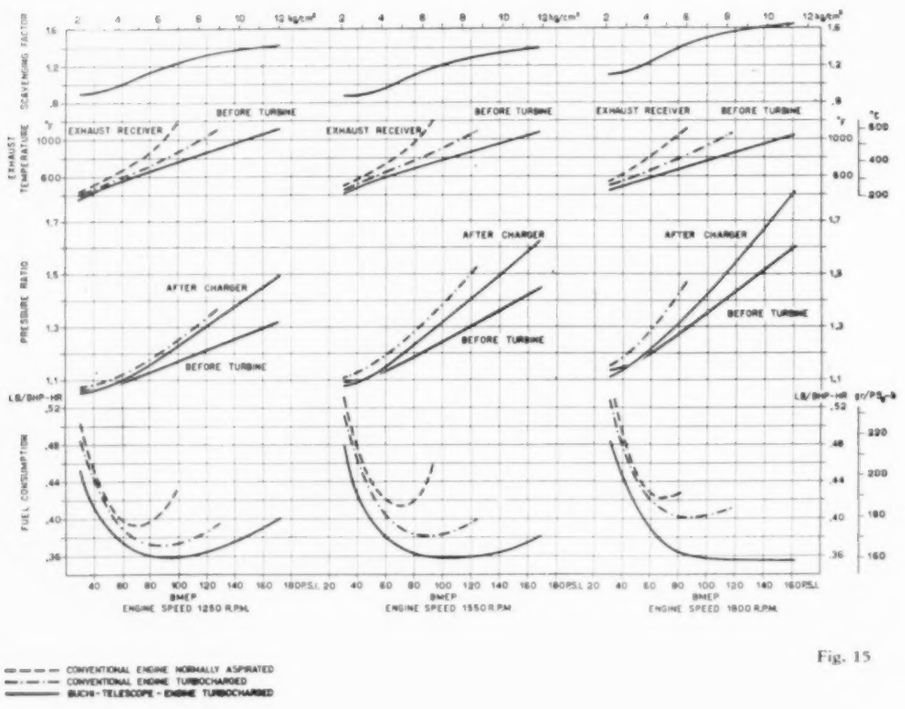


Fig. 15

Figure 15 shows three sets of diagrams in each of which are plotted the fuel consumption, the pressure ratios of the turbocharger, the exhaust temperatures and the scavenging factor as a function of the bmep at 1250, 1550 and 1800 rpm engine speed for a conventional 6 cylinder 4.33 in. x 5.9 in. engine normally aspirated, the same engine turbocharged, and the same engine then equipped with the telescope valve system and turbocharged. It should be noted that at 1250 rpm, engine speed and a bmep of 170 psi, the temperature before turbine is 1120° F. while at 1800 rpm and a bmep of 160 psi, the corresponding exhaust temperature is 1020° F. The scavenging factor gives the value of the amount of air used for scavenging the combustion space plus the amount of air required to renew the air volume in the combustion space. This factor is about 1.65 for the highest charging pressure at 1800 rpm engine speed.

Fig. 18

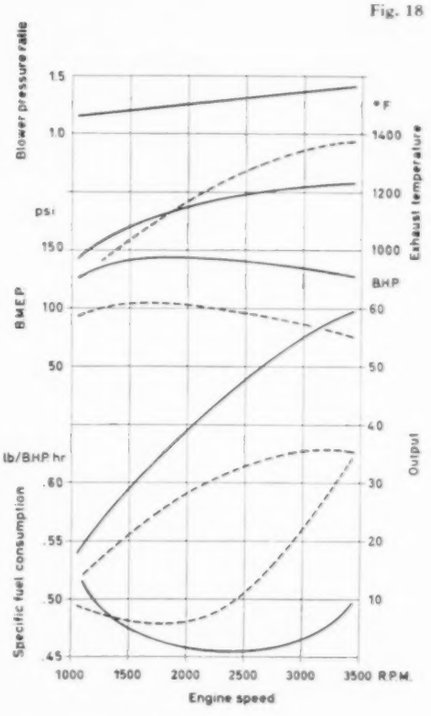


Figure 18 shows curves of the fuel consumption, engine output, bmep, exhaust gas temperatures and charging pressure of a 4 cylinder 2.96 in. x 4 in. engine. The dotted curves refer to the standard engine being normally aspirated while the solid curves refer to the Buchi-telescope-valve-system on the same engine charged by a mechanically driven charger. From these curves it can be seen that the increase of the bmep at the average speed of 2000 rpm amounts to 40% while at the maximum speed of 3400 rpm, the increase is 60%.

TURBO-CHARGER INCREASES TUGBOAT POWER

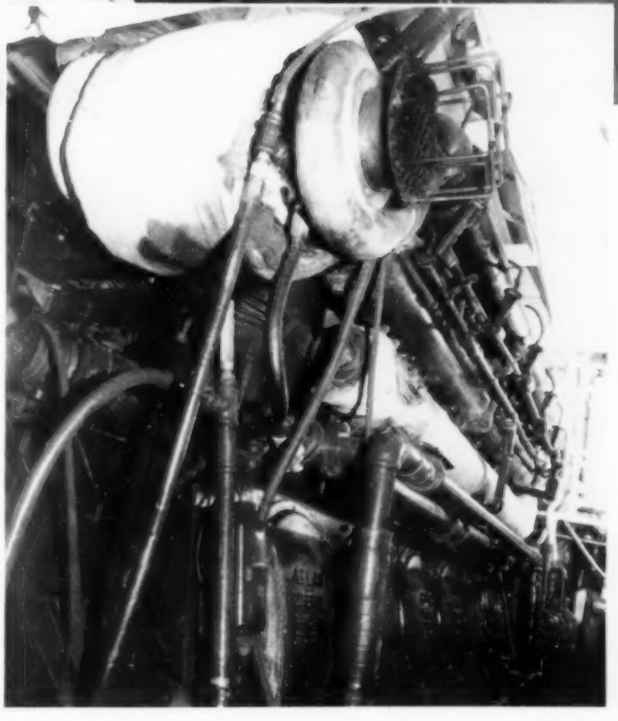
PULLING two barges fully loaded with roughly 900 tons of rock each across 26 miles of open sea is a power-consuming proposition, even for a tugboat propelled by a diesel engine. But the tug, *Conpacco*, of Long Beach, Calif., recently gained a 35-40% power boost in such a situation by installation of an AiResearch turbocharger. Owned by the Connolly Pacific Co., the vessel had been hauling its monstrous-sized cargo from Catalina Island to Redondo Beach, Calif. where the rock is used for construction of a breakwater.

Connolly asked engineers from The Garrett Corporation's AiResearch Industrial Division, for higher engine output. They received that and much more. With the aid of AiResearch's model T3011 unit, the *Conpacco* also acquired a major reduction in maintenance problems, decreased specific fuel consumption, added measurably to its payload, and effected more dependable schedules. The Big White Atlas Diesel engine on the 65-foot *Conpacco* is a six-cylinder power plant with a bore and stroke of 11.5 x 15 inches. Naturally aspirated, this engine developed 280-285 rpm when fully loaded. When turbocharging installation problems were resolved, the speed increased to 313 rpm with no change in propeller. It is worthy of note that, with the aid of the AiRscarch turbocharger, an air pressure of 6.5 pounds was maintained on the engine's intake manifold. Turbocharging enabled the *Conpacco* to reduce the time of a trip in one direction from 12-14 hours to 10-12 hours. This permitted the addition of one more round trip per week to the four previously made. In terms of cargo, it increased the haul of rock by 1,800 tons. Moreover, better controlled operation permitted Connolly to set up more dependable schedules. This brought about substantial cost reduction in coordinating arrival of unloading crews at the Redondo Beach breakwater, and loading crews at Catalina, with arrival of the *Conpacco*.

With the AiResearch T3011 feeding an air flow of 80-85 pounds/minute into the cylinders, engine operating temperatures dropped sufficiently to reduce exhaust temperature from 850 degrees to 700 degrees. The major maintenance benefit as a result was elimination of valve failures. Previously, the excess overload caused valves to burn and crack with an average loss of one every two weeks. In the process of installation, AiResearch engineers determined it was vital to use topgrade oil filters in the engine for proper protection of the turbocharger's rotating unit. Following the initial teething problems with oil filtration, the T3011 turbocharger has undergone 2700 hours of trouble-free operation, and at that point was still going strong.

Mounting of the turbocharger was made directly on the water jacketed manifold of the engine. The compressor discharge was connected by a short length of rubber hose to the end of the intake manifold, and turbine discharge was effected through a short transition piece into a 90 degree elbow and stack without muffler. No change was necessary in the exhaust manifold or camshaft. Buoyed by their success with the *Conpacco*, Connolly Pacific has since had a second tug, the *Rocona*, fitted with an AiResearch turbocharger.

The tugboat *Conpacco*, which received a 35-40% power boost with the aid of an AiResearch model T3011 turbocharger. Below, shot taken from cramped quarters in the *Conpacco's* engine room shows AiResearch turbocharger (upper part of photo) installed on big White Atlas diesel engine.



STARTING OF DIESEL ENGINES AT LOW TEMPERATURES

By JOHN A. KLISCH*

Excerpts from This Very Exhaustive and Interesting Paper Have Been Selected by Our Associate Editor—R. Tom Sawyer

DIESEL engines can be started and operated at temperatures down to −65° F., provided correct fuels, proper control of priming fluids, correct lubricants, adequate enclosures, adequate heating and cranking speeds, and properly trained engine operators are furnished. The reason for this paper** being written was to outline the problems in order to meet military requirements which specify that internal combustion engines be capable of starting and operating at various atmospheric temperatures with issue fuels down to −25° F without the addition of external heat; however, other starting aids are permissible. At temperatures from −25° F to −65° F, the application of heat to the engine is permissible. As the starting of diesel engines is more difficult than the starting of gasoline engines at low ambient air temperatures, it becomes a difficult problem associated with diesel equipment operation. Below are the various methods of cranking the engine.

(1) Electrical Cranking System: At the extreme low operating temperatures, −25° to −65° F, the demands for storage battery output are much greater than at a relatively higher operating temperature. That is, more energy is required to crank an engine at the lower temperatures. To further complicate matters, the output of a storage battery decreases rapidly as the temperature decreases. Therefore, to enable operation at very low temperature, it is necessary to replace the conventional battery by one having a greater capacity and of a type that is designed especially for low temperature operation. In addition, the battery must be heated to enable it to furnish an adequate amount of cranking energy. Also, to permit the battery to efficiently accept a charge from the generator and replenish the expended energy, it is desirable to heat the battery to approximately 40° F.

(2) Auxiliary Power Unit: This is a conventional type gasoline engine which is usually heated below −25° F to enable the starting of it. The engine is either hand cranked or it is furnished with an electric cranking motor that in turn depends on an electric storage battery for energy. This engine serves a dual purpose in the starting of the diesel engine. First, the engine coolant circulates from the cranking engine where it takes on heat, and as the coolant passes through the diesel engine, it gives up its heat to the cold diesel engine cylinder block. The exhaust gas from the gasoline engine may also be utilized for heating components such as the diesel engine intake manifold and the engine oil. The second purpose, of course, is to crank the diesel engine at high enough speed to enable ignition and combustion of its fuel. This type unit has proven quite successful at low temperatures. The adoption of such engine however, is limited to the original design of equipment.

(3) Pneumatic Unit: In personal contacts with shop superintendents of the Erie Mining Company, Aurora, Minnesota, it was learned that the pneumatic starter has performed satisfactorily in their operations at various low temperatures down to −20° F. This system is capable of providing the high cranking speeds that are required to effect ignition and combustion at low temperatures. This type unit is a potential source of cranking energy. It appears that the greatest problem is to prevent moisture accumulation and freezing in the system.

(4) Hydraulic System: This system consists essentially of two major units, the cranking motor assembly and the accumulator assembly (Fig. 1). An inert gas, nitrogen, occupies a portion of the accumulator. To provide cranking energy, hydraulic oil is first pumped into the accumulator against a free floating piston. This in turn compresses the nitrogen which occupies space on the other side of the piston to a pressure of approximately 2700 psig. The second step is to release the hydraulic fluid (pressures on each side of the piston in the accumulator being in balance) into a hydraulic cranking motor. The sudden release of energy provides high cranking torques at high speeds thereby enabling engine starting. This system provided adequate cranking and successful engine starting at atmospheric temperatures down to −40° F. The hydraulic system, since it uses nitrogen and hydraulic fluid as the working media, offers less chance for moisture accumulation and freezing. This system should find many applications in low temperature operations.

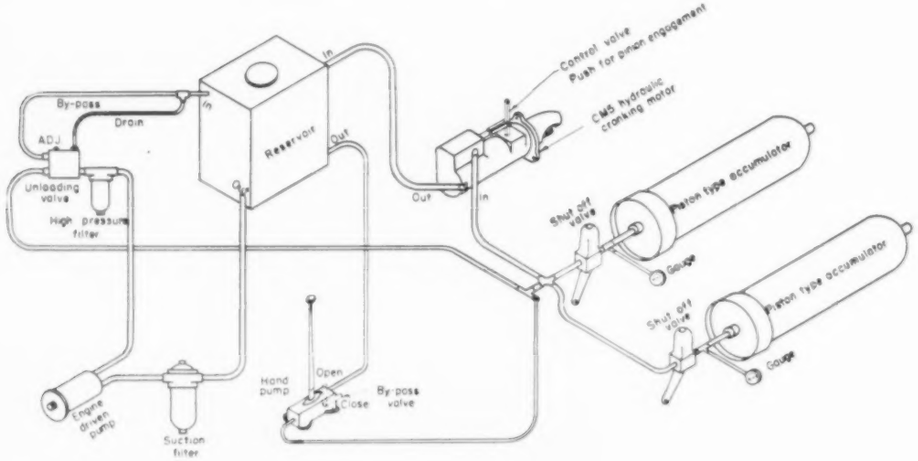
Regardless as to the system used for cranking the engine the engine should be heated before starting in the severe cold as the military requirements specify that the engine be capable of starting within 60 minutes. Effective heating does not depend on the quantity of heat that might be directed at the engine but on the quantity of heat that reaches such strategic areas as the intake air manifold, cylinder walls, combustion chamber, crankshaft bearings, and other areas where cold lubricating offers resistance to cranking. Now let us see what heating devices are available.

(1) Electrical Heating: One type of electrical engine preheating system contains a combination of immersion and strip type heaters. The elements are intended to heat crankcase oil, engine block, oil filters, and fuel near point of injection into engine.

(2) Hot Air Heating: (a) Heating with Fresh Air: Air is heated in a liquid fuel burning heater and delivered to heat such items as the storage battery, engine intake air manifold, engine block, crankcase oil, and electric cranking motor. (b) Heating with Fresh Air and Heater Exhaust Gas: This is another version of hot air heating. In addition to fresh air, the exhaust from the gasoline burning heater is utilized to heat such items as the storage battery and the engine crankcase oil (Fig. 2). (c) Heating with Exhaust Gas: This system employs a liquid burning heater. The hot gases are applied to such items as the engine block, cranking engine, and intake air manifold.

(3) Coolant Heating: (a) Heating with Engine Coolant: The coolant (permanent type antifreeze) is heated in a liquid fuel burning heater and circulated through the engine block. In some installations the heated coolant is further circulated through a heating coil that is installed in the crankcase for heating the engine oil and also through a coil contained in the storage battery box for heating of the battery. (b) Heating with Engine Coolant and Heater Exhaust Gas: In this

Fig. 1. Schematic of hydraulic cranking system. (Courtesy-American Bosch Arma Corporation)



*Mechanical Engineering Dept, U.S. Army Engineer Research and Development Laboratories, Fort Belvoir, Virginia.

**Won first place in a contest conducted by the Washington, D.C., Section of ASME.

version of heating, the heated coolant is circulated through the engine block. The exhaust gas is ducted through a double walled storage battery box and also through a housing enclosing the engine oil pan for the heating of the battery and engine oil respectively (Fig. 3).

Summary

To release electrical energy, the storage battery must be heated to approximately 0° F., and to enable the battery to accept an adequate charge, it should be heated to approximately 40° F. At temperatures below −25° F the auxiliary power unit requires heat to enable its starting. The use of this unit is limited to the original design of the equipment where provisions are made for it. The pneumatic unit has performed satisfactorily in the cranking of diesel engines at temperatures down to −20° F. The unit, however, is exposed to the possibility of collecting moisture, freezing, and becoming inoperative. Information concerning its operating capabilities at temperatures between −20° F and −65° F is not available. Nitrogen and hydraulic fluid are the working media in the hydraulic cranking system. There is no chance here for moisture accumulation. Under laboratory conditions, this cranking system has cranked and started diesel engines at a temperature as low as −40° F. Except for some difficulties that are experienced with fuel ignitors and flame detectors, the heaters are quite satisfactory. Arctic type lubricating oils have produced satisfactory results during laboratory and field tests at various low temperatures down to −65° F. Diethyl ether has performed satisfactorily as a priming fluid in the starting of diesel engines at low temperatures under laboratory controlled conditions.

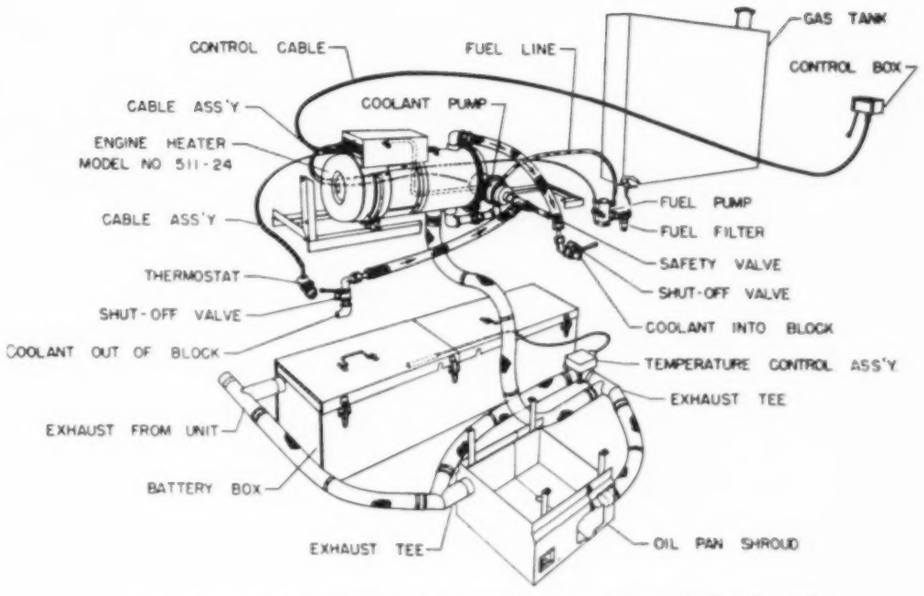
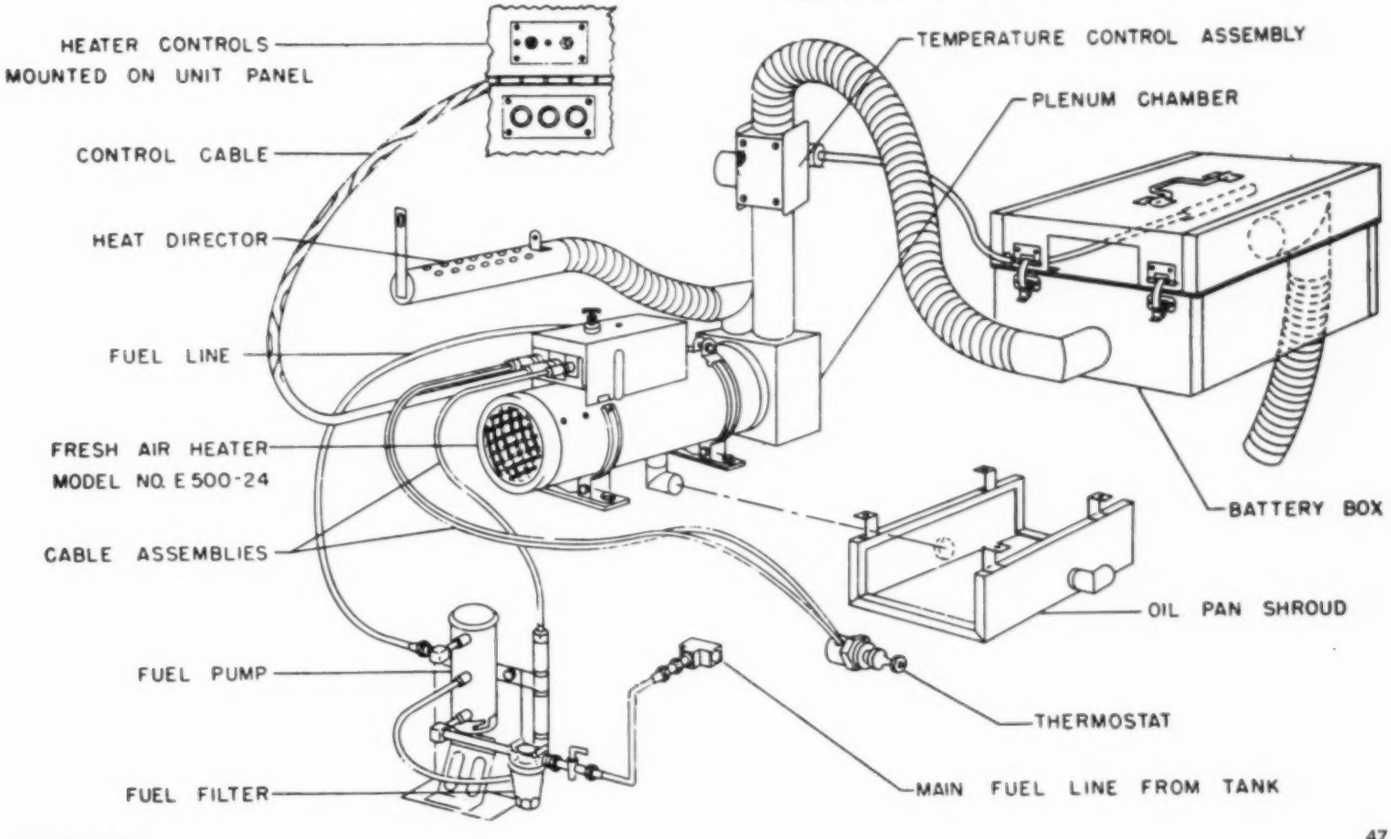


Fig. 3. Typical coolant and heater exhaust system for generator set, diesel engine and accessories. (Courtesy Perfection Industries).

Diesel engines can be started and operated at various low temperatures down to −65° F, provided correct fuels, lubricants, adequate heating, and adequate cranking speed are available. For best results, heat must be directed to such strategic areas as the engine manifold, cylinder walls, combustion chamber, crankshaft bearings and other areas where a cold lubricant offers resistance to cranking. The hydraulic system development program should be capable of providing adequate cranking power for internal combustion engines at temperatures below −40° F. To promote diesel fuel ignition at the low temperatures, an additive such as diethyl ether is required. The know-how of a well trained and experienced operator is a very important factor in the starting of diesel engines at low temperatures. Finally, if present investigations continue and result in satisfactory development of high speed cranking systems, improved and fully automatic priming fuel devices, perhaps little heat will be required to start engines at low temperatures.

Fig. 2. Typical hot air heating system for generator set diesel engine and accessories. (Courtesy Perfection Industries)



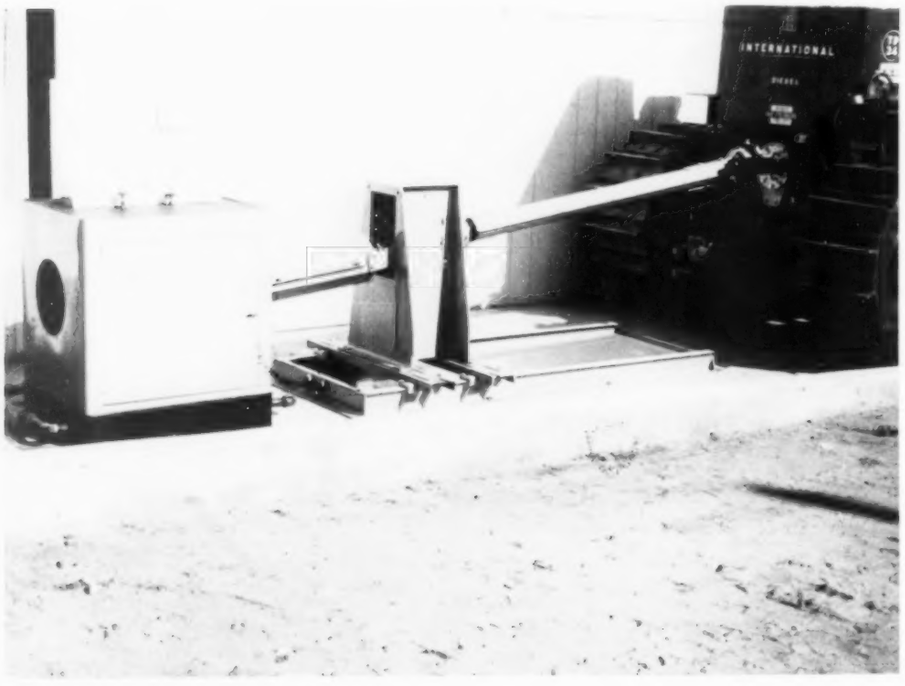
UNIVERSAL TRACTOR TEST EQUIPMENT

A Unique Piece of Test Equipment Which Makes Possible A Variety of Tractor Tests.

By DOUGLAS SHEARING

A BRAND new development in dynamometer testing, the Clayton Universal Tractor Test Equipment, permits testing of crawler tractors and many types of rubber tired equipment without removing the engine from the chassis. The Clayton Universal Tractor Test Equipment is designed for use with the Clayton Series 17-300, 17-500 and 17-700 engine dynamometers, having power absorption capacities of 300, 500, and 700 hp, respectively. The Tractor Test equipment can be installed with the engine dynamometer for tractor testing only, or can be installed with a universal engine test stand to provide a complete dynamometer installation for testing basic engines, power units equipped with mechanical clutches, or torque converters, tractors and heavy duty rubber tired construction vehicles equipped with power take-off drive.

View of an International TD-24 tractor being tested on a Tractor Test Stand; in this case the intermediate support is mounted on the crossrail supports of an engine test stand to save space.



The Universal Tractor Test Equipment consists of an intermediate support, to which the standard or heavy duty double universal joint engine dynamometer drive shaft is connected, a constant velocity (Rzeppa type) power take-off drive shaft, a Clayton Universal power take-off drive assembly, power take-off mounting adapters (four provided for all popular makes of tractors), a universal drive coupling and bushing for connecting to tractor p.t.o. drive shafts, and guards for both the engine dynamometer drive shaft and the tractor power take-off constant velocity drive shaft. The characteristics of this equipment provide for testing tractors and heavy duty rubber tired construction equipment powered with engines rated up to 450 hp and developing up to 1800 lbs ft torque at the power take-off. It will accommodate all equipment having power take-off shafts from 17 in. to 51 in. above floor level and will allow for testing tractors positioned up to 6 in. on either side of the dynamometer center line. This equipment will also provide testing of basic engines, power units with mechanical clutches, or torque converters, rated up to 700 hp, developing up to 2600 lbs ft torque and weighing up to 24,000 lbs.

When the tractor test equipment is used with the dynamometer only for testing tractors, or when it is installed at the opposite end of the dynamometer to the universal engine test stand, the intermediate support is mounted directly to the floor. If, due to space limitations, one end of the dynamometer will be used for testing both engines and tractors, the intermediate support can be mounted on the cross-rail supports provided with Clayton engine test stands. The intermediate support bearing and shaft assembly position is ad-

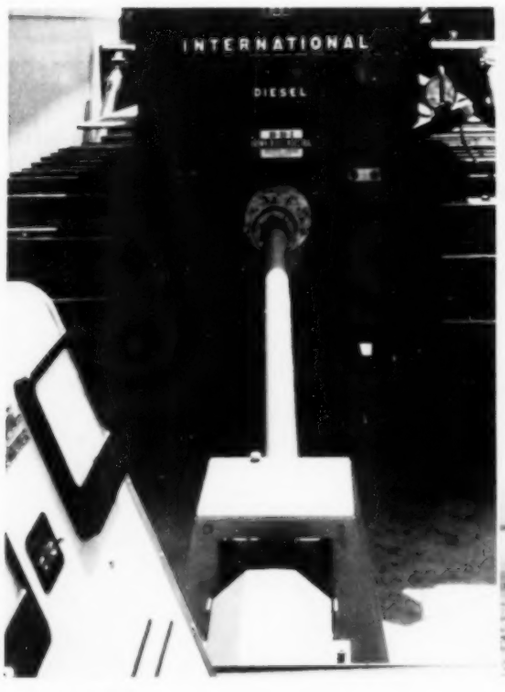
Model of a crawler tractor being tested on Clayton Universal Tractor Test Equipment. A universal engine test stand is installed on the right hand side of the dynamometer making this equipment capable of handling tractors and individual engine units as well.

justable to accommodate the p.t.o. height variation of all tractors. The tractor power take-off drive shaft is connected to the intermediate support drive flange and the universal power take-off drive assembly. A power take-off drive coupling and bushing is provided for connecting the universal power take-off drive assembly to the tractor transmission shaft. This coupling can be welded to a standard tractor power take-off shaft used for driving cable control or other tractor accessory equipment. The drive coupling only is required when tractor shafts of 2.52 in. diameter or greater are used. For tractor shafts with less than 2.52 in. diameter, the bushing is also required. The power take-off drive coupling and bushing can also be attached to fabricated shaft and transmission coupling assemblies.

Four power take-off drive adapter plates are provided to cover all most popular makes and model tractors. The flange of the power take-off drive assembly will connect directly to the rear case of Allis-Chalmers HD5A, HD5B, HD6, HD6A, and HD6B; International Harvester T6, TD6, T9, and TD9. The dynamometer drive shaft guard connects between brackets attached to the dynamometer frame and the brackets of the intermediate support. Power take-off drive shaft guard mounting rings are provided for installation to both the power take-off drive assembly and the intermediate support. These mounting rings provide a universal joint action for the guard to accommodate the p.t.o. drive shaft angles of incline and decline incurred when connecting to various tractor models. It also provides a side angle when tractor is positioned up to 6 in. on either side of the dynamometer center line. With both the dynamometer shaft and power take-off drive shaft guards properly installed, maximum safety is assured. For installations where the tractor test floor is 8 in. below the engine dynamometer test floor, or where the dynamometer and engine stand are mounted 8 in. above floor level, the power take-off drive shaft can be connected directly to the dynamometer drive flange, thus eliminating the need for the intermediate support.

Universal Tractor Test Equipment with intermediate support mounted directly to the floor.

Regardless of the type of installation, the universal application and flexibility of the Universal Tractor Test Equipment provides safe, efficient testing. It is convenient to use and enables tractor service operations to guarantee the power and performance after service has been performed, as a feature of new equipment make-ready and for making a true evaluation of the used or trade-in tractors.



Close-up view of intermediate support and constant velocity shaft and connection to p.t.o. shaft on an International tractor.

A Caterpillar D8 crawler tractor installed on the dynamometer, ready to be tested out.

WHAT'S GOING ON IN ENGLAND

CONDUCTED BY **BERNARD W. LANSDOWNE**

Bernard W. Lansdowne is an associate member of the Institution of Mechanical Engineers and is widely known among British and European diesel manufacturers as a former editor of our English contemporary "Gas & Oil Power." His early workshop training was spread over seven years with A.E.C. Ltd., Southall, following which he served some five years with that company's sales engineering department. He is now specializing in industrial advertising with Roles & Parker, Ltd. in London.

New National Vertical and Horizontal Designs

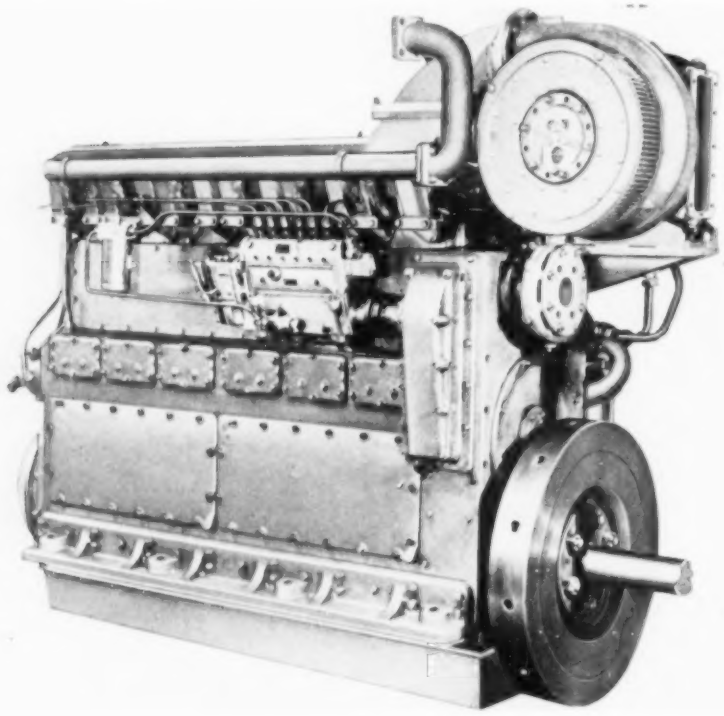
A NEW series of 6 and 8 cylinder engines, known as the NM range, has been introduced by the National Gas and Oil Engine Company Limited, Ashton-under-Lyne, England. Vertical and horizontal versions are available and the former can be mechanically blown, turbocharged or turbocharged with intercooling if desired. The horizontal version can be either normally aspirated or mechanically supercharged and has been developed mainly for railcar and shunter duties. The cylinder dimensions are bore 6 in. and stroke 8½ in. The strength of the crankshaft, the dimensions of which exceed Lloyd's requirements, can be judged from the main and crank pin bearing diameters of 5.3 in. and 4.5 in. respectively. The crankshaft is of high duty heat treated alloy steel and is surface hardened. The piston speed at the normal maximum running of 1500 rpm is 2125 ft per minute, and the output per cylinder ranges from 41 bhp for the normally aspirated design to 66 bhp for the turbocharged inter-cooled design.

The engine is built on a strongly ribbed monobloc cast crankcase of high tensile iron, in which the crankshaft is carried in undershung copper-lead bearings. Inspection doors permit the withdrawal of all pistons and connecting rods without the removal of cylinder heads or manifolds. A lubricating oil sump with cross baffles to prevent oil surge, is fitted below the crankshaft and is removable. The cylinder liners are of the wet type and each is registered in the crankcase and held against its joint by the cylinder head, the open end being located in the crankcase but free to expand. The liners are interchangeable and may easily be replaced. They are of close grained cast iron and are chrome hardened internally. The cylinder heads are of the 4-valve type, the two exhaust valves having high grade cast iron inserts in the cylinder heads. Cast iron is also used for the cylinder head, the design of which gives a compact form of maximum strength. The aluminum alloy pistons each carry three pressure rings, and two oil scraper rings, the top pressure ring being housed in a cast iron insert. The pistons are joined to the H section alloy steel connecting rods by a fully floating gudgeon pin, which itself is carried in a replaceable bush. The rods are drilled for lubrication of the piston pin and the big ends are fitted with replaceable copper-lead shell bearings.

The valve mechanism is on conventional lines with a single camshaft machined from solid forged bar. Each cam operates two valves in each cylinder head through push rods and levers, all the levers running in replaceable bushes. The wearing surfaces on the camshaft and the levers are case-hardened and ground, the drive to the camshaft, together with that for the fuel pump, water pump and oil pump, being taken from the flywheel end of the crankshaft. Fuel injection pumps of the block type are fitted together with a lift pump which enables the fuel supply to be positioned lower than the engine if necessary. The governor is integral with the fuel pumps and is driven by the fuel pump camshaft.

A single air manifold supplies air to each cylinder via twin ports in each head. In the case of normally aspirated and mechanically supercharged engines the exhaust manifold is water-cooled and is suitable for use with the outlet at either end. A lube oil gear pump is housed inside the sump and oil is circulated through the engine after passing through the oil cooler and filter. All major oil passages are drilled in the crankcase itself so that internal oil piping is reduced to a minimum and the possibility of breakdown due to unseen failures is minimized. Engine cooling water passes through the engine crankcase and then divides; a portion passing through the cylinder heads and the remainder through the jacket of the water-cooled exhaust manifold, thus providing efficient cooling of all parts of the engine. The water then leaves the engine in a single water outlet manifold from which it may be piped to the radiator. The temperature may be regulated by a thermostatic bypass valve which also enables the engine to warm up quickly from a cold start. If required, a radiator fan may be driven by Vee belts from the free end of the engine. Remote-reading water and lubricating oil thermometers can be provided if required. Either air-in-cylinder or electric motor starting can be supplied to suit individual requirements.

National NMS6 type 6 cylinder turbocharged diesel rated 360 bhp at 1500 rpm.



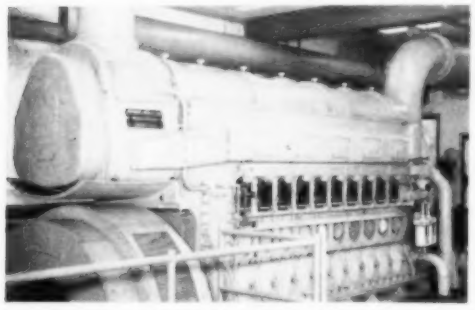
DEVELOPMENT OF A FILTER

A PIONEER filter manufacturer serving the Diesel Industry, Wm. W. Nugent & Co., recently celebrated their 60th Anniversary. The company was started in 1897 by William W. Nugent, and its product development history parallels the history of diesel engine development in this country. F. Lee Townsend, General Sales Manager of Wm. W. Nugent & Co., has cooperated in supplying the following description of the evolution of Nugent products for filtering engine lube and fuel oils as new diesel engine designs were developed and applied through the years. It is an interesting illustration of the way that all elements in an industry must pull together to achieve progress, in this case engine manufacturers and the suppliers of all important accessories. By comparison to the engines of today, early internal combustion engines were large, heavy, slow-speed machines. The lubricating oil did not operate under as heavy loads nor was it required to act

Illustration of a representative fibre disc is also shown above.

as such an important medium of heat exchange, hence the small lubricating oil pumps of that day had sufficient capacity to keep the engine bearings well lubricated. To filter and clean the lubricating oil of these engines, the Nugent bag type filters were developed for full flow filtering, cleaning the lube oil every cycle. In some cases, where oil pump capacity was a problem, a percentage of the lube oil was bled, or by-passed, from the engine lubricating system and filtered through a bag filter by gravity. The bag type filter, with its ability to form a filtering bed with the contaminants collected inside the bag, helped to maintain low wear rates and clean operating engines. Many of the earlier internal combustion engines are still running today with bag type full flow lube oil filters. This type of filter, even now, is used on smaller units. With further development, greater horsepower and higher speeds were required of internal combustion engines with corresponding increases in heat rejection and lubricating oil pump capacities. Full flow filtering of the lube oil with the bag type filter was limited because of price and size of the filter required. To keep the lubricating oil conditioning equipment within reason, the engine builders adopted the metallic type strainer for full flow lube oil protection. It was soon learned that oil filtering with the strainer was not sufficient to maintain the engine oil within the required limits and many engine builders added the by-pass method of filtering. The full flow strainer would remove the larger foreign particles, while the by-pass filter would remove particles down to a very fine size from a certain percentage of the oil at every pass. The idea was that eventually all of the very fine particles would be eliminated. Cotton waste packed filters were generally used for the by-pass filters. While the cotton waste depth type filter returned clean oil to the engine sump, the amount of oil bled from the engine lubricating system was necessarily limited since it was not desirable to reduce the engine oil pressure by bleeding off too much oil for filtering. Consequently, an insufficient amount of oil was filtered to maintain satisfactorily clean oil for the lubricating system. Multiple by-pass filters for larger capacities improved the oil conditioning, but larger by-pass filters, with the increased cost to engine builders, were often not economically attractive.

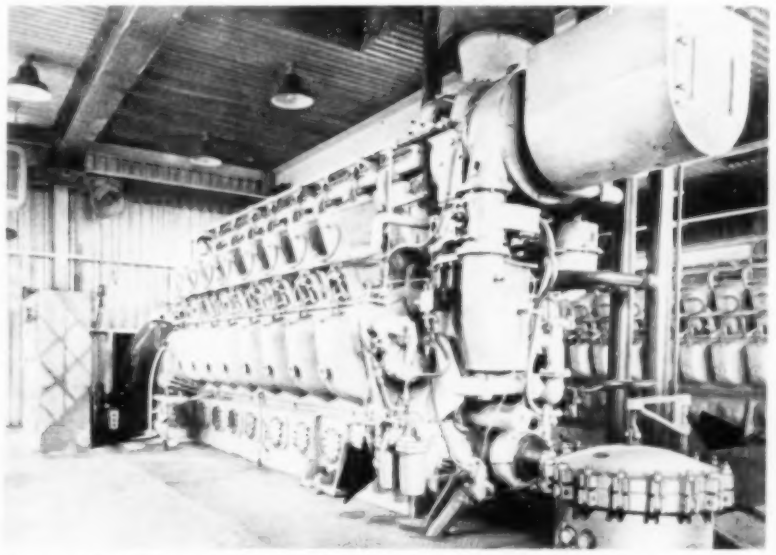
This Fairbanks, Morse opposed piston diesel installed in the Wells, Minnesota municipal power plant is protected with Nugent fuel oil filters shown at right.



Continuous use of straight mineral lubricating oils often resulted in an acid condition. This state was improved with by-pass filters of the fullers' earth type. Then the oil companies, who wage relentless war against engine wear and dirt, brought out detergent type oils to trap acid forming contaminants before they could go to work. It is believed inadvisable to use the fullers' earth adsorbent type filter with the modern additive oils since the additives may be removed from the oil by the fullers' earth. Where additive type oils are used, by-pass filtering with cellulose cotton waste type filters has been employed with success.

The recent development of the Nugent laminated cellulose disc type filter with its large filtering area makes it possible to filter all the lubricating oil of today's high output, high-speed engines at every pass. The filter element consists of a stack of similar crenulated fibre discs, each rotated 15° from the position of the adjacent disc, thus affording proper flow of oil through the element and a maximum filtering capacity. It is used with additive type oils and has improved the operating characteristics of straight mineral oil by micronic filtration of the contaminants in the oil. Today's internal combustion engines, with the improvements in engine design, decreased clearances, higher speeds and higher temperatures, require full flow filtration of lubricating oils for maximum protection.

The development of Nugent fuel oil filters for diesel engines has followed the same trend as those for lubricating oil. Micronic size particle removal from fuel oils is now possible for better protection of injection systems. With the trend to heavier residual fuels, proper filtration of fuel oils becomes even more important.



Nugent full flow lube oil filter in right foreground and fuel oil filters on engine protect this Alco 251 diesel installed at the Laton, Kansas pumping station of the Service Pipe Line Company.

Illustration of a complete Nugent laminated disc type filter cartridge. This is a full flow type filter cartridge.

These Ingersoll Rand engines installed in a gas transmission pipeline compressor station are equipped with Nugent full flow lube oil filters—one of the units showing at right.

GAS TURBINE PROGRESS

A COMMENTARY BY R. TOM SAWYER

R. Tom Sawyer's well known in the gas turbine field having been the first chairman (1944) (and now treasurer) of the Gas Turbine Power Division of ASME. He spent 7 years with G.E. Transportation Dept., and 26 years with American Locomotive, now Alco Products. At present he is a Consultant, including "Consultant to the Staff" of the Experimental Towing Tank at Stevens Institute of Technology. In addition to being a Fellow Member of ASME and AIEE, he is a member of SAE, ARS, ANS, IME in London, DEUA in London. He is also a member of Franklin Institute and a Professional Engineer. Mr. Sawyer is the author of *The Modern Gas Turbine* and *Gas Turbine Construction*, and co-author of *Applied Atomic Power*.

Lycoming Gas Turbines

ONE by one the reciprocating engine builders add the gas turbine to their line of power units. Lycoming has now done just that with two free power turbines, the T53 and T55. With over six years of development many of the T53's are now being used in helicopter service, for which it was designed. The T55 was designed as a turboprop; however, either unit may be used in either service as shown by Table 1.

TABLE 1

Model		Max. Power	Output Speed	Overall Length	Overall Diameter	Weight
T53-LTC1B-1	Turboshaft	825 hp	6680 rpm	47.6"	23.0"	480 lbs
T53-LTC1F-1	Turboprop	960 hp	1700 rpm	58.85"	23.0"	495 lbs
T55-LTC4A-1	Turboprop	1500 hp	1290 rpm	58.85"	24.25"	695 lbs
T55-LTC4B-1	Turboshaft	1600 hp	6230 rpm	44.04"	24.25"	600 lbs

Our main story on this page is to show how these units can be used in other than aircraft applications. We could give a list of industrial, marine, and stationary and mobile applications where it is possible to use this unit. Rather than go into these details let us first inspect the turbine unit, then see one application, marine use.

Details of Gas Turbine Unit

Figure 1 shows the cutaway of the T53 unit (the T55 is similar). The 5 stage axial compressor has a centrifugal unit which boosts the air pressure into the annular combustor, and from there through the compressor turbine. The single stage free power turbine on the extreme right drives through the center of the compressor shaft to a sun gear at the front end on the left. This is a good arrangement in not having any interference with the exhaust gases. When operating as a turboprop a thrust is obtained from these exhaust gases. The T53 as shown in Fig. 1 is currently powering the Army Bell helicopter. Several of these installations have been made and are examples of the new possibilities in helicopter design provided by the use of turbines. A noticeable decrease in cabin noise level is experienced with an external mounting arrangement, which also serves to reduce fire hazards as well as to provide additional cabin space. Another installation is that in the Air Force Kaman HOK-1, normally powered by a seven cylinder reciprocating engine. Other aircraft applications include the Mohawk, first army turboprop plane; Doak, Ryan and Vertol VTOL/STOL projects for the Army and the Twin-turbine Vertol 105 helicopter.

Navy Hydrofoil Craft

A Navy research craft which flies over the waves on water wings will soon be propelled by the T53 power plant. The hydrofoil boat shown in Fig. 2 was developed by Miami Ship-Building Corporation under Bureau of Ships Contract. It can attain speeds in excess of 34.4 miles per hour. The hydrofoil consists of airplane-type wings attached to the boat and extending below the surface of the water. As the speed of the boat increases, the wings develop sufficient lift to raise the entire hull of the boat above the water. The boat then skims along over the surface reducing drag and thereby achiev-

Fig. 1—Cut away view of the Lycoming T53 free power turbine unit.

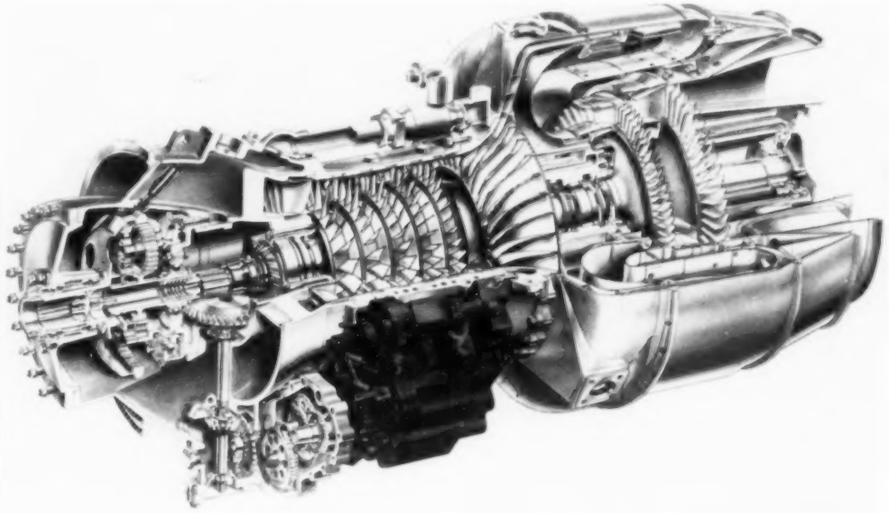
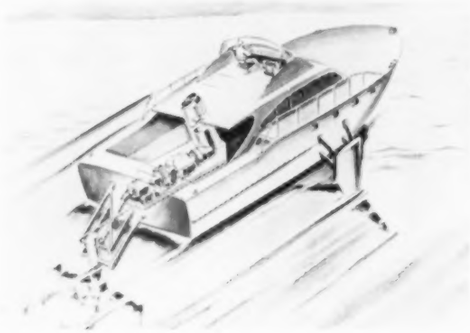


Fig. 2—Navy Hydrofoil craft. The Lycoming turbine unit is clearly shown.



ing greater speed and a smoother ride. Just as in the related aircraft field, the Lycoming T53 engine, because of its lightness, makes possible improved performance characteristics for hydrofoil-type boats. It will be noted in Fig. 2 that the T53 turbine, model LTC1B-1, is mounted as low as possible to drive aft at a maximum speed of 6,600 rpm into a light, compact reverse and reduction marine gearbox. Jered Industries, Inc. designed and constructed the unit in the form of a simple epicyclic transmission; hydraulically operated multi-place clutches holding the appropriate ring gear elements to provide ahead and astern operation at an appropriate speed ratio of 3.0:1 in each case. A neutral clutch is used to facilitate gear shifting and the entire gearbox weighs 519 lbs. Clutch operation and turbine power level controls are interconnected and the operation of the whole package is carried out with a single lever quadrant. The gearbox pedestal serves a double purpose as it is constructed to duct air from a hydraulically driven cooling fan mounted on its forward face to the turbine and gearbox oil coolers located on either side. The oil tank is situated beneath the turbine inlet housing.

The air inlet compartment mates with ducting through the ship's deck and a simple screen and water spray ring protects the inlet and enables salt deposits to be washed from the compressor blades. Both the air inlet and turbine compartment cowls are hinged for inspection and service purposes. A hydraulic system operating at 3,000 psi is provided for exterior use and also to operate the cooling fan. The hydraulic pump is coupled direct to the turbine power take-off drive and operates with a supercharged inlet pressure of 50 psi as a completely closed circuit. The exhaust system is separated from the rest of the package by a fireproof bulkhead. Naval specifications called for the exhaust gases to be turned at low loss through 100 degrees, and an exhaust air eductor system was required to cool the compartment and limit the outer stack skin temperature to 140°F. This worked very well.

Great Lakes District Manager

Philip Wallach

Appointment of Philip Wallach as District Manager of the Great Lakes Territory of the Engine Division of Nordberg Manufacturing Company has been announced by R. W. Bayerlein, Division Vice President. Mr. Wallach will make his headquarters at a new District Office which Nordberg has established in Cleveland. The Office is located in The Agents Building at 3537 Lee Road, Cleveland 20, Ohio. Mr. Wallach joined Nordberg two years ago as a Sales Engineer and since that time has concentrated his work in the marine, utility and pipeline markets. Nordberg's Great Lakes Territory now includes the States of Michigan, Indiana, Ohio, West Virginia, western Pennsylvania, western New York and the greater Toronto, Ontario area. Mr. Wallach will follow marine engine application for the Great Lakes and inland waterways as well as utility, pipeline and industrial engine sales.

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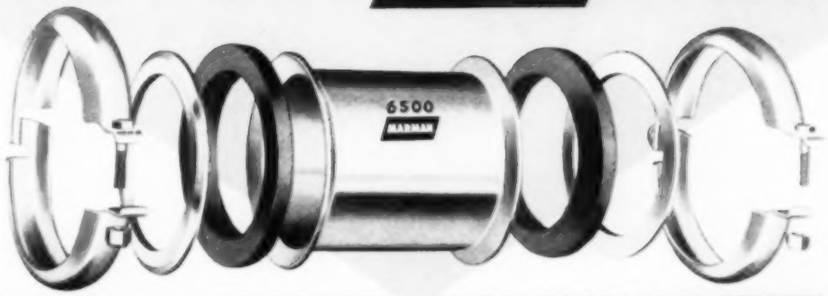

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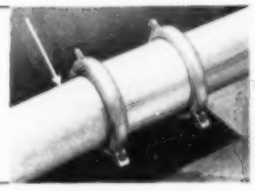

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Unique Fill-Compactor

An impressive speed of eight miles per hour is claimed for this 100,000 lb fill-compactor, put to work recently by the Mittry Construction Company of Santa Maria, California. The Diesel-powered unit, designed by Mittry engineers to speed up tamping operations on large earthmoving jobs, is shown left at a dam site near Santa Maria, where it was keeping pace with 22 18-yard bottom-dump earthmovers. It has four drums equipped with sheepsfoot tampers and does the job of three ordinary tractor-drawn tampers, according to F. R. Mittry, Jr., head of the Construction Company.

Power for the giant compactor is provided by two six-cylinder Series 71 GM diesel engines delivering 200 hp each through Allison Torqmatic transmissions. The Diesels were supplied by the Anderson-O'Brien Company of Los Angeles through their dealer, the Gem Equipment Company of Ventura.

West Coast Manager

Lawrence G. Downey

In a move to expand sales and service operations on the West Coast, Hercules Motors Corporation has announced the assignment of Lawrence G. (Larry) Downey, veteran of 30 years experience in sales and engineering, to direct western activities from its headquarters in Los Angeles. William L. Pringle, president of Hercules, said Mr. Downey will supervise the development of sales of Hercules engines as well as distributor and dealer sales and service in 11 western states, the Canadian western provinces and Alaska. In expanding activities on the West Coast Mr. Downey will make his headquarters at the Hercules Motors factory sales and service branch located at 2336 S. Garfield Ave., Los Angeles.

Marine Diesel Electric Plant

A new, improved Series of Marine diesel electric plants has been placed on the market by D. W. Onan & Sons Inc., Minneapolis. Introduced, but not formally announced, at the New York Boat Show last January, Series 3MDSL will provide 3,000 watts of electric power for all types of craft. It is designed and built specifically for marine use and has all the built-in safety features for below-deck installation. Conservatively rated, this new Onan generating set has plenty of power for appliances, communications, lights and motors. Series 3MDSL electric plants are available in standard 60-cycle, ac voltages; in combination 115 volts, 60-cycle and 32 volts dc; and in both 32 volt and 110 volt dc battery chargers.

The vertical, single-cylinder, 4-cycle, water-cooled engine, manufactured by Onan, is a solid injection full diesel unit. An Onan-built, all-climate, insulated generator is direct-connected to the engine making a single, rigid set. Removable cylinders, allowing easier service and replacement; simplified plumbing, making a neater, more efficient and compact unit for easy installation; an improved, new control panel and a mounted power take off pulley are a few of the many new features of Series MDSL. For complete details write to D. W. Onan & Sons Inc., Minneapolis 14, Minnesota.

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- highest thermal efficiency
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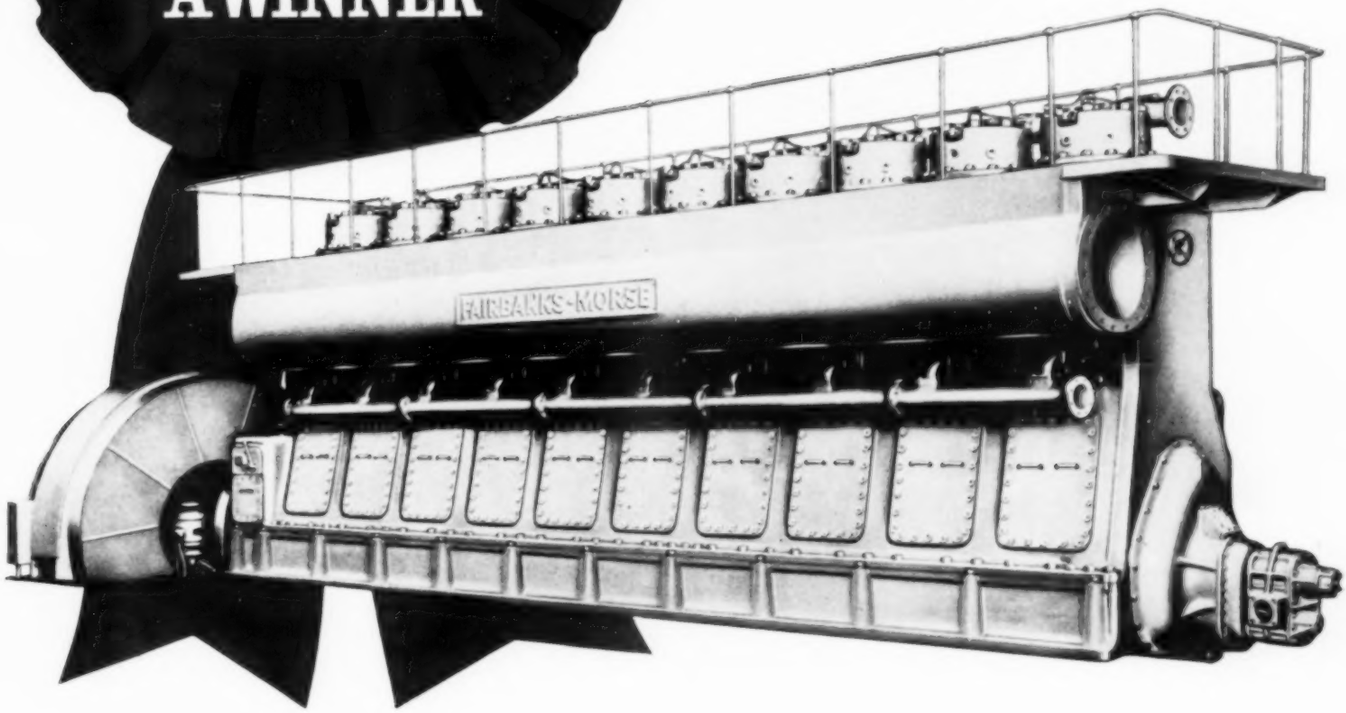

Key men of the Lea County Electric Cooperative—General Manager R. B. Moore (r) and Superintendent of Electric Operation Clyde R. Price, standing by one of seven F-M engines.

Through mass efficiency, matchless F-M dual-fuel engines carry Nation's top REA plants to victory year after year!

Look at the record:

1957 Lea County Co-op plant, Lovington, N. M., wins first—with four 18 x 27, three 16 x 20 F-M engines—despite efficiency-robbing operation at 3900 ft. above sea level!

1952 Wolverine Co-op plant, Hersey, Mich. wins first with three F-M 18 x 27 Model 31 engines.

1953 Wolverine wins again.

1954 Wolverine again most efficient, but ineligible through rules.

1955 Wolverine wins again; declared permanently ineligible.

Wheatland Co-op plant, Scott City, Kan., wins second—with four F-M 18 x 27 engines.

In 1957 at the Lea County Co-op plant, generating 47,387,000 kw-h, or 74.6% of the total energy, the seven F-M engines averaged only 2.575 mills per kw-h for fuel and lube oil—8% less than the average for the other make engines in the plant.

One F-M engine—the most efficient in the plant—held the figure to 2.505 mills, with only .471 for pilot oil and .194 for lube oil. Another F-M engine was the most efficient on a thermal basis, requiring only 9727 BTU's per kw-h.

Although some of the F-M engines topped the 30,000-hour mark during the year, average operating cost for fuels, lubricants and maintenance was only 2.639 mills per kw-h—with maintenance alone held to $3,033.99, or .064 mills per kw-h.

And here's another significant point: the three plants with lowest labor costs during 1957 were Lea County, Wolverine and Wheatland. Using Fairbanks-Morse engines, these plants averaged only .923 mills per kw-h, 25% less than the next lowest plant in labor costs!

Year after year the official statistics prove it: Fairbanks-Morse diesel and dual-fuel engines are unparalleled for low generation cost and reliability. You can't make a better buy in power. Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Ill.

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Gulf Coast Diesel Notes

By Michael T. Pate

ADAMS Shipyard, La Rose, Louisiana, has taken delivery from Stewart & Stevenson Services, Inc., Houston, Texas, of a 6-cylinder General Motors marine diesel, series 71, model 6071-E, rated at 200 hp, and equipped with 4.5:1 hydraulic reduction and reversing gear.

LONE Star Refrigerated Seafoods Company, Brownsville, Texas, is repowering three of its trucks with Harnischfeger diesels secured from Diesel Engine & Equipment Service Company, Houston. A model 687-C, rated 280 hp, is being put into an Autocar; a similar unit in a GMC model 900; and a model 487-C, rated 200 hp, is being placed in a model 750 GMC truck.

GENERAL Engineering Company, Fort Worth, Texas, has bought from Stewart & Stevenson Services, Inc., Houston, a Stewart & Stevenson model 12GDT300-S 300 kw generating set with automatic operation for use as emergency stand-by power. The unit is driven by a series 71, model 12108-T turbocharged General Motors diesel.

KIRKWOOD & Morgan Drilling Company, Alice, Texas, has taken delivery from Waukesha Sales & Service, Inc., Houston, of two model 6LRDBSU Waukesha diesels, rated 540 hp each at 1100 rpm. The diesels will furnish prime power for an oilwell drilling rig.

CLAYTON'S Electric Company, Wichita Falls, Texas, has taken delivery of a Stewart & Stevenson model 6GD108-C 100 kw ac generating set, driven by a series 71, model 6030-C, 6-cylinder General Motors diesel.

ASIATIC Petroleum Company, through its New York City office, has taken delivery of two Stewart & Stevenson explosion resistant ac generator sets, a 5 kw unit and a 6 kw unit, each driven by an air-cooled Petter model AVA-2 diesel. The units were sold by Stewart & Stevenson Services, Inc., of Houston.

ACE BRAKE Service, San Antonio, Texas, has bought from Stewart & Stevenson Services, Inc., Houston, a 180 hp long base, closed type diesel unit, driven by a 6-cylinder, series 71, model 6029 General Motors diesel.

HIDALGO County Water Control & Improvement Districts 7 & 14, Mission, Texas, have bought from the Diesel Division, Fairbanks, Morse & Company, Chicago, three 7-cylinder model 38F5¼ diesels, rated 525 hp each.

MAGNET Cove Barium Company, Houston, has secured from Stewart & Stevenson Services, Inc., Houston, a quad-6 series 71, model 24103 General Motors diesel which was unitized with the Magcobar company's 350 kw ac generator.

PIONEER Centrifuge Company, Houston, has taken delivery from Stewart & Stevenson Services, Inc., Houston, of a 2-cylinder, closed type, series 71, model 2031-C General Motors diesel, rated 40 hp.

HERMES Equipment Company, Lafayette, Louisiana, has taken delivery from Waukesha Sales & Service, Inc., Houston, of a pair of model 180DLCU Waukesha diesels, each rated 31 hp at 1800 rpm.

EQUIPMENT Supply Company, El Paso, Texas, has bought through Stewart & Stevenson Services, Inc., Houston, a closed type series 71, model 3031-C General Motors diesel, rated at 60 hp.

SOUTHWESTERN Industrial Elec-

AAF Type W Cycoils assure clean air to gas compressors at this field processing plant of the Odessa Gasoline Company in Ector County, Texas.

AAF Cycoils protect compressor equipment day-in-day-out—require little maintenance

Why are AAF Cycoil oil bath air cleaners used for so many unmanned pumping stations and automatic plants? The reason is simple: Cycoils are known and *trusted* for dependability and efficiency. What's more, they require only infrequent maintenance because filter pads are self cleaning. Periodic replacement of oil is all that's required.

Cycoils' method of intermixing oil and dust-laden air traps 90% of the fine dust particles before they ever reach the final filter pads. That's why Cycoil-cleaned air is virtually 100% dust-free!

Whether it's a pulsating action or smooth flow application, involving packaged or stationary compressors, there's a Cycoil of a type and capacity to meet your needs. Write today for bulletins describing the complete line of Cycoil oil bath air cleaners.

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— BETTER AIR IS OUR BUSINESS —

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Cycoil Oil Bath Air Filters

tronics Company, Houston, has taken delivery from Stewart & Stevenson Services, Inc., Houston, of a General Motors series 71, 4-cylinder, model 4031-C closed type diesel, equipped with an Allison Torqmatic transmission.

CLAUDE Crosby, Freeport, Texas, will power his 55 ft by 16 ft boat, the *Claudette C*, with a pair of Harnischfeger model 687, 210 hp diesels, each equipped with a model HYC-6900 Capitol hydraulic reduction and reversing gear with 2:1 ratio. The diesels were sold by Diesel Engine & Equipment Service Company, Houston.

FOSTER Cathead Company, Wichita Falls, Texas, has taken delivery from Waukesha Sales & Service, Houston, of a model 180DLCU Waukesha diesel, rated 31 hp at 1800 rpm.

W. A. SCHAFFER Shows, Dallas, Texas, has taken delivery on three Stewart & Stevenson model 110GD125-S 125 kw ac generating sets, each powered by a series 110, 6-cylinder, model 62408 General Motors diesel.

NATHAN Boudoin and Senet Duay, Aransas Pass, Texas, have bought from Stewart & Stevenson Services, Inc., Houston, a General Motors series 110, 6-cylinder, model 62207-T diesel. The turbocharged diesel is equipped with a 4.5:1 hydraulic reduction and reversing gear, and is rated 300 hp.

STEVENS Lumber Company, Livingston, Texas, has bought from Diesel Engine & Equipment Service Company, Houston, a model 687-C Harnischfeger diesel, rated at 280 hp which will furnish power for a portable sawmill.

O-K FRACTURING Services, Cushing, Oklahoma, will power one of the company's sand-fracturing units with two General Motors series 110, 6-cylinder, model 62408 diesels, rated 200 hp. The diesels were furnished by Stewart & Stevenson Services, Inc., Houston.

EDWARDS Transportation Company, Houston has bought from Stewart & Stevenson Services, Inc., Houston, a 200 hp 6-cylinder series 110, model 62206 General Motors marine diesel equipped with 3.75:1 hydraulic reduction and reversing gear. The company also took delivery on an 80 hp 4-cylinder, series 71, model 4031-C closed type General Motors diesel.

Boring Machine

Greenlee Bros. & Co., Rockford, Illinois, announces a larger capacity Hydro-Borer, the model S-7. It is a low cost, precision borer for boring large assemblies or small individual pieces. The S-7 Hydro-Borer is compact for its heavy feed capacity. Overall dimensions are 34½ in. in length, 7¾ in. high and 5½ in. wide. Spindle diameter is 1¾ in. with a #3 Morse taper. Length of stroke is 6 in.

Feed per revolution is .0035 in. reducible to .002 in. Rpm ranges are 465, 900 and 1400. The S-7 is specifically designed for mounting on workholding fixtures or large assembly jigs. The S-7 Hydro-Borer features Greenlee's patented feed principle. This enables the S-7 to bore to close tolerances with a good quality finish. The S-7 can be equipped with manual, solenoid or air-operated controls. For further information about the S-7 Hydro-Borer contact Greenlee Bros. & Co., Rockford, Illinois.

ITS NEW

HERE IS IMPORTANT INFORMATION! The completely new 1958 edition of the **DIESEL ENGINE CATALOG,** Volume 23, is now available. If you design, purchase, sell, operate or service diesel, dual fuel or gas engines, the Catalog is essential to you. This giant, 400 page, 10½" x 13½", fully illustrated reference book has been revised, rewritten and brought up to date completely from cover to cover. Send your order in now for this limited edition, which costs $10 postpaid plus California sales tax where applicable. Send checks or company orders to **DIESEL ENGINE CATALOG,** 816 N. La Cienega Blvd., Los Angeles 46, Calif.

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newly built for
Captain Peter Andersen
and his brother
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long-time
New Bedford fishermen

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WAUKESHA
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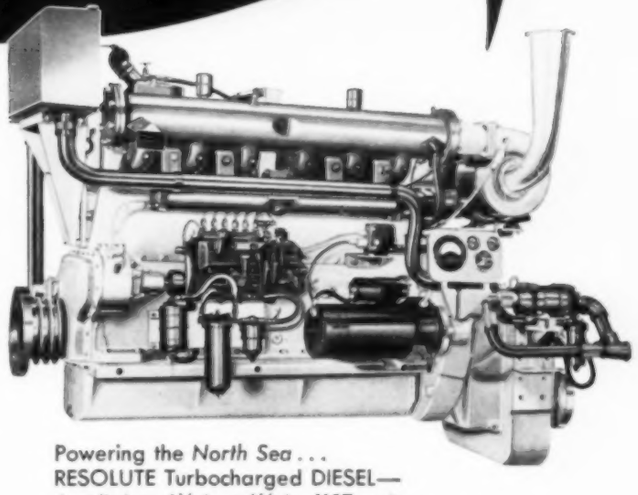

Newly built for the Andersen brothers . . . and named for the waters where they fished as youngsters . . . the *North Sea* is a recent addition to the New Bedford fishing fleet.

Built from a round stern Condon design . . . by Harvey F. Gamage, Shipbuilder, South Bristol, Maine . . . this 72′ dragger has a 17′6″ beam, 9′6″ draft. Tonnage is 67 gross, 46 net. The Fiberglas-insulated hold carries 65,000 lbs. of iced fish. Her full complement is nine men.

Powered by a Waukesha Resolute, the vessel's speed is 10 knots. As modern as marine engines come . . . this turbocharged Diesel puts out up to 260 hp on 24-hour duty. Fuel is carried in four welded steel tanks; 2000 gallon capacity.

Electronic equipment includes Edo radar, Bendix radio-telephone; Bendix depth recorder, Bendix direction finder and two Loran sets.

The Captain is Peter Andersen; the Engineer, Harman Andersen, his brother. They are second generation fishermen; started as crewmen. Out of New Bedford for many years, the Andersens have operated and owned several fishing boats. Their choice of Waukesha power for the *North Sea* is a tribute to the reliability of Waukesha Marine Engines.

Powering the *North Sea* . . .
RESOLUTE Turbocharged DIESEL—
six cylinders; 6¼-in. x 6½-in., 1197 cu. in. displacement; 260 hp at 1600 rpm for 24-hour duty.

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For easy starting . . . safety . . . simplicity . . . smoothness . . . and economy—Waukesha Marine Diesels. Sizes: 426 to 5788 cu. in. displ.; Normal or Turbocharged up to 990 hp for 24-hour duty.

Send for Bulletin 1691

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN
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375

Diesels All Around The World

By F. Hal Higgins

AMERICAN Tractor Equipment Corp. has just put on the market two hydraulically controlled scrapers to work behind the Wagner TR9 and TR14 model wheel tractors. Wagner standardized on Cummins engines two years ago and has gained considerable headway in both the Canadian logging and big grain farming areas of the Northwest, and also in the Salinas valley vegetable, bean and grain fields, according to the Oliver dealer who also handles the Wagner.

SEAMAN-Gunnison Corp. has come up with a new double-service roller that becomes a sprinkler at the turn of a valve by the operator. Its Duo-Pactor uses water ballast in its roller and this liquid weight can be gravity-fed to a sprinkler bar. Steel and rubber compaction are combined in the same unit. Optional sheepfoot rollers can replace drive wheels and a vibratory unit adds to the versatile machine's range.

GALION Iron Works announces its 503 motor grader with increased job range by adding the Jackson electric vibratory compactor. An independent engine and generator is mounted at the rear end of grader frame to power the compactor.

FAIRBANKS-Morse recently published a new 60-page book for prospective customers for its diesel engines, scales, pumps, motors and generators, railroad products, etc. It is beautifully illustrated with pictures of its factories and branch houses throughout the U.S.A. and Mexico as well as photos of typical applications of its big diesels in marine, power plants and rail installations. F-M has come a long way since the original Fairbanks in Vermont put his scales on the market in 1830.

A PAIR of GM diesel engines are doing great work on a new freeway by-pass at The Dalles, Oregon, on the Columbia river that forms the mighty inter-state line between Oregon and Washington. A 6-110 model powers a Lorain 2½-yard shovel that loads a LeTourneau-Westinghouse rear dump with the same brand of engine under its hood. Around 6,000 yards a day are being moved on a 100,000-yard job of moving a rocky cliff out of the way of motor progress.

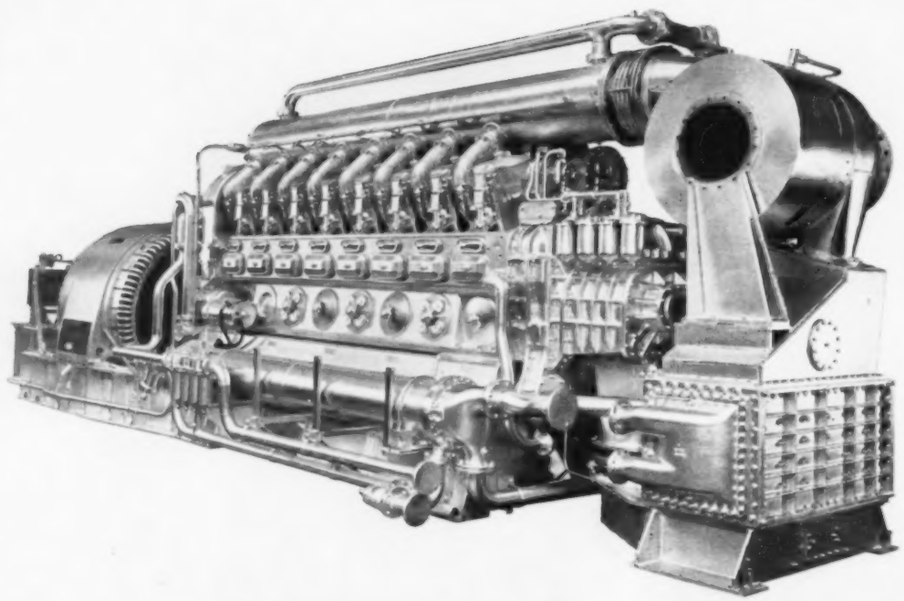
MASSEY-Harris-Ferguson has a million dollar program of plant expansion at its Brantford, Canada, plant. A foundry for producing the large castings for tractors that have been purchased from outside sources is one big item in this expansion.

J. I. CASE Co. sales increased 42% last year. It was a jump from nearly a million dollars in the red to nearly a million and a third profit. With its big Phoenix show of new equipment booking record sales, 1958 will show another healthy increase, officials say.

ONE-MAN mechanization of all five stock feeding in which the green crop is cut, loaded and unloaded into open lot mangers by diesel-powered wheel tractors is the big trend in both dairy and beef cattle feeding to cut costs and lift profits. The movement has been gaining rapidly recently and the late spring that has delayed planting of crops and given pasture and hay crops a heavy growth with ample moisture for big crops at a time when live stock herds are being enlarged, has stimulated farmer demands for the latest green crop harvesters with diesel wheel tractors equipped with the latest hydraulic controls.

GLENN County, Calif., farm income was up over five million dollars last year from 1956, says Agricultural Commissioner P. V. Harrigan in his annual re-

Finest **2000-KW. Diesel-Generator Set** *Designed for* **The Power Plant**



A Rugged, Compact Assembly featuring—

✓ Cleveland Diesel 16-cylinder Turbocharged 2-cycle Diesel Engine
✓ Simplified Installation
✓ All Standard Voltages and Frequencies Available
✓ Attached Pumps, Cooler and Filters
✓ Integrated Engine-Generator Design

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Engine Division of General Motors • Cleveland 11, Ohio

GM 1908-1958

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port. This was the highest ever recorded for Glenn and reflected higher yields. Glenn is one of the best diesel tractor areas in the state in the big crawler year-round models that can do the farm work on schedule regardless of weather. Lots of land leveling and shaping goes with its rice, grain, field seed, almond, walnut and other crops.

HYSTER fork-lift trucks are equipping with Perkins diesels for the first time. But this British diesel engine is also getting a growing place in Canadian and U.S. vehicles, fishing boats, diamond drills, generators and other industrial tools.

CHRYSLER in its European models is offering Perkins diesels as alternative original equipment in its cars and buses.

ARGENTINA, Brazil, Iran, Iraq, Israel, Japan, Kuwait, Russia, the U.S.A. and Venezuela all increased their imports of British diesel engines last year. A big drop in small gas engines is noted at the same time, showing the strong trend to diesels to replace gas with more efficient power.

MILITARY men are studying the big saving in transport of fuel if diesel instead of gas engines were adopted. It would save close to 60% in transport space, it is claimed. The transport of gasoline to Alaska during World War II could have been eliminated by having diesels burn unrefined oil from fields in the Arctic, say engineers who were on the job and noted the tremendous cost of getting gasoline up to that area to fuel the gasoline engines that one particular auto manufacturer had supplied the U.S. Army.

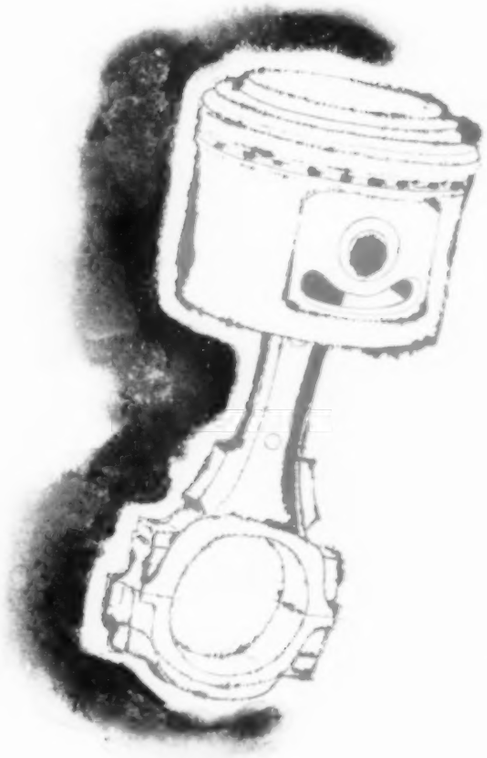
DEMAG Baggerfabrik GMEH of Germany now has its line of new models of diesel-powered Universal Excavators, Bulldozers and Slewing Cranes ready for the U.S. heavy construction market. Bulldozers in two sizes—90 and 150 hp; Universal excavators on both truck and tracks in 16 models in ½ to 6 yd sizes, in both diesel-electric and electric models for the larger sizes. The Deutz engine powers their diesel models.

Dual Purpose Tool

With the increasing use of valve seat inserts, Hall-Toledo, manufacturer of valve seat grinding machines and tools, is introducing a new dual service tool to ream valve guides oversize and counterbore the head or block, prior to inserting valve seat rings. Both operations are accomplished by a single machine setting. Besides simplifying valve service work, the single setting assures a high degree of concentricity between the valve guide and the insert ring. Expandable cutters permit the counterboring of any diameter within the range of the tool, with a variation of 7/8 in. to 3-5/16 in.; plus spinner and clearance blades. Design of the Hall-Toledo tool provides for accurate control at any angle up to 45° from the gasket face of the cylinder head or block. For complete specifications write for data on Model MR Valve Seat inserter–Valve Guide Reamer. Hall-Toledo, Inc., 2931 South Ave., Toledo 9, Ohio. (ITS NEW)

New York Branch Manager

William Peters has been named manager of the New York City branch office for American Air Filter Co., Inc. Peters comes to AAF from the Anemostat Corporation of America, where he was assistant general sales manager. C. A. Pickett, AAF sales manager, said the appointment was effective April 1, 1958. A graduate of Cornell University, with a BS degree in mechanical engineering, Peters served in the Navy during World War II, as a Lieutenant aboard the aircraft carrier USS Hornet. Peters, 39, is married and the father of a 14 year old son.



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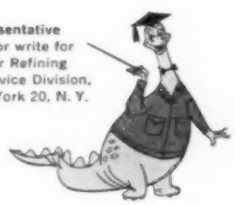
The longer your pistons work before need of ring replacement—the less your cost of operation. Sinclair Rubilene® Oils have the reputation for giving longer service to cylinders, rings and other vital parts. Refill with Rubilene now. Next time management asks how you've cut costs, tell them you've switched to Sinclair—and show them the results.

Call your Sinclair Representative for further information or write for free literature to Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. There's no obligation.



SINCLAIR Rubilene® Oils

troit engines rated at 300 hp each. ing the new Power Equipment Division. Several key personnel have already been prototype production and will eventual-

Inland River Reports

By A. D. Burroughs

TWO Model 8 DATMR Allis-Chalmers engines, rated at 300 hp each, supply propulsion power for the two new vessels just completed by Calcasieu Shipbuilding Corp., La., for Sea Service, Inc. Named the *Gas Service* and *Bay Service*, the 85 by 22 ft crafts were equipped with engines from Mechanical Equipment Co., New Orleans.

THE *Norfolk*, a familiar tug in southern waterways is being rebuilt, renamed, and repowered. Owned by Florida Towing Corp., Jacksonville, Fla., the new name will be the *C.M.* The tug is the third converted from steam to diesel for this company, and makes a total of 17 tugs in operation. The new power will come from a Cooper Bessemer engine.

AT PASCAGOULA, Miss., the F. B. Walker yards have construction underway for a refrigerated menhaden vessel, making the 9th in the Walker fishing fleet. The 136 ft craft will be powered by tandem GM engines, and equipped with 9 other GM engines for other auxiliary purposes, all supplied by the Biloxi, Miss. firm, Kennedy Marine Engine Co.

CURRENT construction at Dravo includes a near-twin to the brand-new *Crescent City*, the 148 by 34 ft towboat delivered to the Sioux City & New Orleans Barge Lines with 3200 hp supplied from GM engines.

TWO 12 cyl Cummins turbocharged engines, each rated at 405 shp turn bronze Ferguson propellers through Capital reverse-reduction gears to provide ample push power for the new *Carolyn M.* The combination tug-towboat, completed by Mobile Ship Repair, Inc. for Gulf Marine, will be used to transport cement for the Ideal Cement Co.

A COMBINATION push-pull 32 by 10 ft utility craft has just been completed for stock at Diesel Shipbuilding Co., Jacksonville, Fla. A GM Model 4-71 engine will supply the power.

LUCKY BOY, the fifth for the fleet operated by M. C. Boat Co., Inc., Morgan City, La., is in action powered with Cummins engines, model NHRMS-600, rated at 300 hp at 1800 rpm. The 50 by 16 ft vessel was constructed by WAM, Inc., Siracusaville, La.

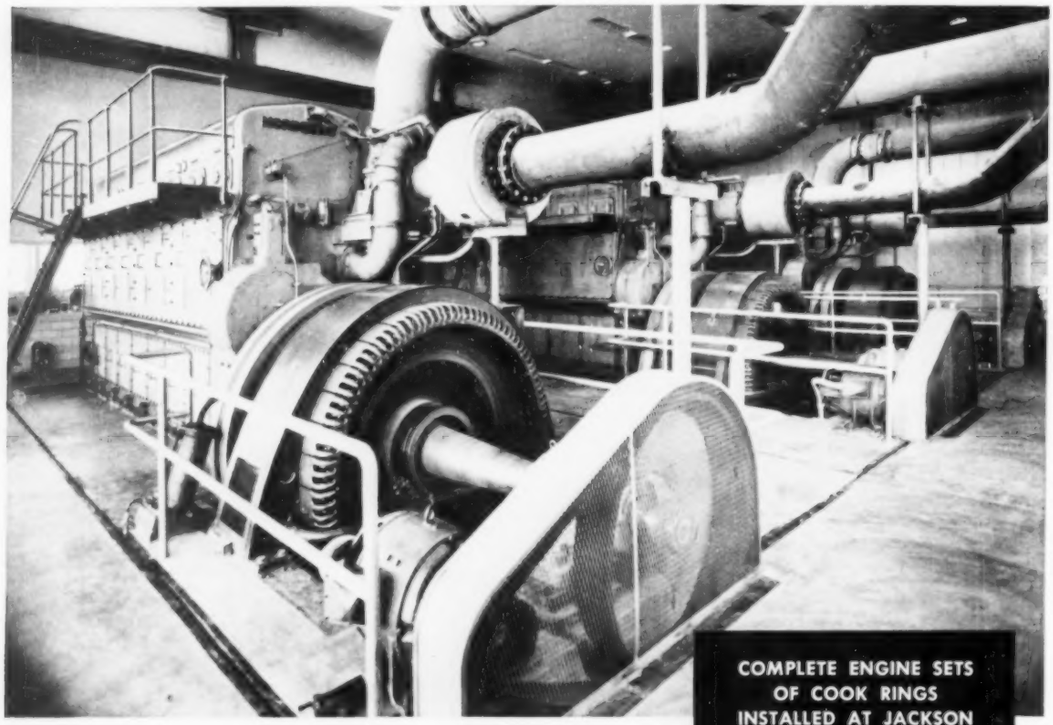
TWO TUGS, for undisclosed owners, are being constructed at Diesel Shipbuilding Co., Florida. Each tug measures 65 by 17 ft, with main propulsion power supplied by two Cat engines.

CATERPILLAR engines power the new *Ila M.*, new switchboat in action for Bernhardt Brothers, Wis. Built and designed by Dubuque Boat and Boiler Co., Iowa., the craft is reported to be a beauty, both in appearance and in performance.

A UNIQUE combination passenger-freight vessel is under construction at the Christy Corp. Sturgeon Bay, Wis. yards. The 165 by 34 ft vessel will have 75 in. diameter KaMeWa wheels turned by the 600 hp Kahlenberg turbocharged engines. To be named *Ranger III*, the boat is to operate between Houghton, Mich., and Isle Royale in Lake Superior.

THE A. L. Mechling Barge Lines anticipates delivery of a brand-new tug from Dravo sometime in July. The 1200 hp tug will carry GM Cleveland engines for main pulling power.

THE *Shifty III*, a new harborboat measuring 40 by 20 ft is near completion at Tampa, Fla., by the Hendry Corp. The craft will be equipped with a Murray and Tregurtha propulsion and steering unit, with power from a pair of GM De-



COOK rings help Jackson (Minn.) R.E.A. plant win "Diesel Progress" efficiency plaque!

IT takes good operating supervision and good equipment to walk off with top honors in *Diesel Progress'* annual R.E.A. efficiency contest. In Division "A" (5,000 kw and under) the winner was Jackson, Minnesota.

Cook piston rings had a big part to play in keeping power output up and cost per kw down at Jackson. Cook rings were installed in the No. 3 unit in this plant in 1953, and they're still going strong!

Perhaps Cook rings could help you, too. For complete information on Cook Piston Rings and the name of nearest representative, write: C. Lee Cook Company, 940 South 8th Street, Louisville 3, Kentucky.

C. LEE COOK COMPANY
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Rings and Packings Since 1888

COMPLETE ENGINE SETS OF COOK RINGS INSTALLED AT JACKSON

COMPRESSION RING

No. 101. This standard graphitic iron, one-piece compression ring provides maximum ring life, and minimum cylinder wear.

SEALING RING

No. 109. This two-piece companion ring for the 101 is used in the third and fourth grooves. It is the proven remedy for blow-by.

OIL WIPER RING

No. 303-DCX. One-piece conformable oil wiper ring with lifetime coil spring assures uniform contact pressure. Wide channels and multiple notches allow direct flow to drain holes.

troit engines rated at 300 hp each.

TWO 800 hp engines supplied by the White Diesel Engine Division, White Motor Co., Springfield, Ohio, will power the new 125 ft towboat under construction by Ingalls Shipbuilding Corp. The towboat will be named the *Wm. Lowndes Lipscomb* and is expected to replace the U.S. Engineers' *Charles H. West*, a long-used steamer.

THE christening ceremonies of the *Refill* were well-attended at Vicksburg. The 55 by 18 ft boat has 600 hp provided by two GM Detroit 6-110 engines, plus a lengthy list of quality equipment including Allison reduction gears, Gould pumps, Curtiss air compressor, and Kahlenberg horn. The neat craft was up into immediate operation for owners, the Vicksburg Mid-River Services, Inc.

ON THE water, the *Bob Benter* and the *Queen City* were running in the Upper Ohio, working for the Ohio River Company with beautiful push power supplied from the Baldwin-Lima-Hamilton main engines.

TO OUR photo gallery goes the new picture of the beautiful power package, the towboat *J. B. Chauvin*. This still-new craft is equipped with three Fairbanks-Morse OP engines for the 1800 hp to give a profitable performance Berwick Bay Towing Co., New Orleans.

NEAR the Cumberland River, on our trip North, we saw the *A. D. Haynes II*, the big boat towing for Mississippi Valley Lines with power from the Nordberg engines.

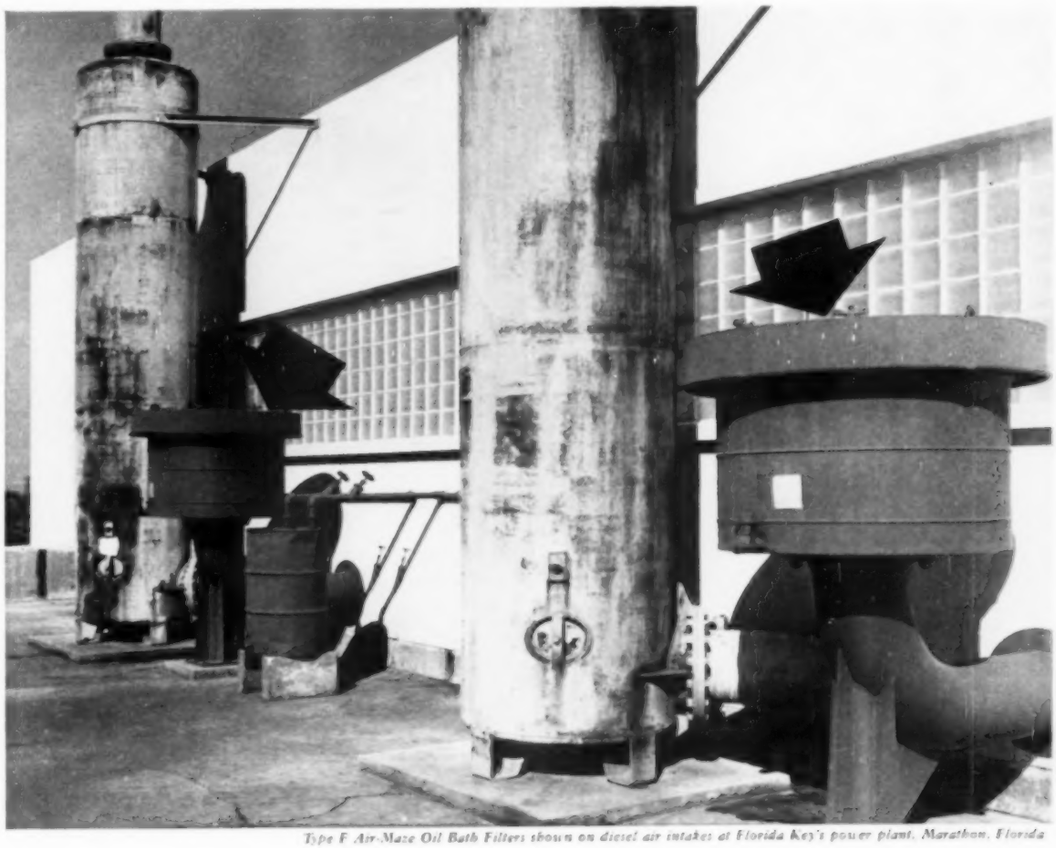
A NEW and fast crewboat, *Black Gold*, has been delivered by builders Star Marine Manufacturing Co., to Hauser Boat Rental, in New Orleans. The vessel has a speed rated at better than 30 mph, with power from two GM Detroit Model 6071A engines.

READY FOR final testing at Arnold V. Walker yards in Pascagoula, Miss. is the sea-going tug for Crescent Towing & Salvage Co., New Orleans. The 98 by 25 ft craft is powered with two Waukesha turbocharged engines rated at 900 hp.

Announces Power Equipment Division

The formation of a new Power Equipment Division to produce electric-generating plants and related equipment was announced recently by Anthony Sperdini, president of Jeta Metal Fabricators, Inc. The Jeta company is a designer-producer of sheet metal panels, cabinets, housings, cases, dollies and related products for industry. In announcing the new Power Equipment Division, Mr. Sperdini said "Our decision to enter the electric-generating equipment field was made only after careful study of market potentials and as a step toward greater diversification of Jeta's products and markets. We have long been a sub-contractor and it was a natural step for us to become a manufacturer of the finished product."

Several key personnel have already been selected to form the divisional management. Howard C. Beyer, well-known engineer and administrator, is general manager of the new division and Michael Campagnale, a specialist in generating-plant manufacturing, is directly assisting him in the completion of final facilities and personnel procurement. The new division is already at work on prototype production and will eventually design and manufacture a wide range of electric-generating plants, both standard and custom. A number of uses for this equipment by industry and the Military is anticipated, including missile and aircraft ground support, as stand-by or constant power for hospitals and other institutions, and for portable power in the general construction field.



Type F Air-Maze Oil Bath Filters shown on diesel air intakes at Florida Key's power plant, Marathon, Florida

Eight types of Air-Maze air filters for every diesel engine requirement!

THE TYPE F AIR FILTER shown is only one of eight different types that Air-Maze supplies the engine and compressor industry.

For large volumes of air with extremely low pressure loss, the Automaze self-cleaning curtain filter or the LPD cylindrical type are available.

The DA dry type is selected when varying air flow is encountered or where an oil-free filter is required.

Multimaze and DH panel assemblies provide adequate impingement filtration where dirt loads are low and where low initial cost is a factor.

Type J stack type oil bath filters are designed for smaller air volumes on mobile equipment.

Electromaze electronic filter is used where submicronic dust must be removed.

To select from the widest line of industrial filters anywhere—whether for air or for liquids—check with Air-Maze first. AIR-MAZE CORPORATION, Cleveland 28, O.

AFI MEMBER

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AIR FILTERS
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LIQUID FILTERS
OIL SEPARATORS
GREASE FILTERS

Mid-West Diesel News

By L. H. Houck

ONE OF many new pieces of diesel powered equipment used on the $50 million Chrysler Corp., Plymouth assembly plant under construction in St. Louis, is a 600 cfm Chicago Pneumatic rotary air compressor powered with a GMC 6-110 diesel. It was being used by piling contractors, Spencer, White & Prentis, Boston, New York and Detroit, to power a Vulcan No. 1 pile driver being used to drive 10 in. H steel piles to refusal.

TWO Allis-Chalmers HD-11-B dozers with AC diesel and an Insley Model L back hoe powered with a 3-71 GM to C. B. Contracting Co., Eldon, Mo., from Chiles Tractor & Machinery Co., Springfield, Mo.

TO NU MINE Coal Co., Gunnison, Colo., a 320 hp NHRS-6 Cummins diesel to power a generator unit, from Cummins Diesel Sales Corp., Denver.

GIL Boers Equipment Co., 7625 S. Kedzie, Chicago, is a new Murphy diesel dealer with northeastern and central Illinois and northwestern Indiana, specializing in power units and generator sets.

NEW KSD-TV transmitter in St. Louis, has a GM 2-cycle diesel with direct-coupled Delco generator as standby power. This equipment will automatically power the station when commercial power fails in 20 to 30 seconds. Western Machinery Co., St. Louis, supplied the equipment.

TWO HD-6-G Allis-Chalmers Tractoshovels to Fenix & Scisson, contractors, Tulsa, making a fleet of 10.

JAMES MULLINIX, Windfall, Ind., has repowered a Diamond T truck with a 190 hp HRF Cummins from Cummins Diesel Sales Corp., Indianapolis.

A DIESEL-powered Case TerraTrac to J. W. Spires, Cabot, Ark., from Rogers Equipment Co., North Little Rock. Spires is a pond and terracing contractor.

AN HD-6-G Allis-Chalmers Tractoshovel to Whittle Construction Co., Dallas, Tex., from Chiles Tractor and Machinery Co., for a Springfield contract.

OMAR Bakeries has installed a couple of 175 hp JT-6-B Cummins diesels in IHC-DCO-205's trucks.

GEORGE WOODS, Monett, Mo., has added an Allis-Chalmers HD-16-A with dozer to his equipment spread. Sale was made by Chiles Tractor and Machinery Co., Springfield.

GLEN LYTLE, Nebraska City, Neb., has repowered a Kenworth D118 with a Cummins NH-220 diesel, from Cummins Mid-West Co., Inc., Omaha.

TRI-STATE Warehousing & Distributing Co., Inc., Joplin, specialist in hauling explosives, radioactive materials, missile and rocket materials, now has a fleet of six GMC cab-over units with 6-71 diesels.

JAMES River Special Road District, Galena, Mo., added an Allis-Chalmers Model 45 motorgrader with Allis-Chalmers diesel to its fleet. Sale was made by Chiles, AC dealers at Springfield.

FABICK Tractor Co., Jefferson City, St. Louis, Salem, Ill., showing the new Caterpillar series DW20 and DW21 wheel tractors with the new Caterpillar Super-Turbo engine which provides 320 hp plus higher torque. The new highway program in Missouri plus the federal highway activity is causing contractors to look over the bigger equipment offerings.

CUT FUEL COST 50%

Since they switched to "Jimmy" Diesel

Railroads are switching to General Motors Diesel engines in maintenance-of-way equipment for the same good reasons as in motive power. Look what happened when the Wabash Railroad replaced a gasoline engine with a "Jimmy" Diesel in this track cleaner.

Superintendent of Work Equipment R. S. Stephens reports *a 50% reduction in fuel costs!* A 3-cylinder GM Series 71 Diesel, replacing an 8-cylinder gasoline engine, uses only 10 to 25 gallons of low-cost fuel in 6 hours—average consumption about 3 gallons per hour. And the machine maintains steady production, loading 40 cubic yards of ballast into hopper in 10 minutes.

Thinking of repowering on- or off-track equipment? Thinking of buying a new tractor, loader, tie-tamper or ballast cleaner? You'll get work done faster and save on fuel and upkeep with GM 2-cycle Diesels. Single engines 30 to 300 h.p.; multiple units up to 893 h.p. Ask your GM Diesel distributor for the facts—or write us.

DETROIT DIESEL Engine Division of General Motors, Detroit 28, Michigan

GM GENERAL MOTORS DETROIT DIESEL POWER

Regional Offices: New York, Atlanta, Detroit, Chicago, Dallas, San Francisco

Parts and Service Worldwide

Now—more than ever—
It pays to standardize on GM Diesel

—available in 1485 applications of power equipment built by more than 175 manufacturers

A GM "3-71" Diesel powers track cleaner used by Wabash Railroad near Decatur, Illinois

GILLIOZ Construction Co., Inc., Monett, added two HD-16-A Allis-Chalmers tractors to its fleet of AC equipment numbering more than 100 units.

CUMMINS 175 hp JT-6-B was the new power plant installed in a White 3000-TD by Buck Kaiser, Carlisle, Indiana. Cummins, Indianapolis, were dealers.

BURKE Construction Co., Springfield, has purchased a TS-260 Allis-Chalmers motor scraper from AC dealer, Chiles, for use on his Springfield contracts.

MANITOWOC County Highway Dept., Manitowoc, Wis. has repowered a Manitowoc 1½ cu yd shovel with a 160 hp H-6-BI Cummins diesel from Cummins Diesel of Wisconsin, Milwaukee.

JACK McCULLOCH, Lebanon, Mo., terracing and farm pond contractor, has added an Allis-Chalmers HD-11-B to his spread. Sale made by Chiles.

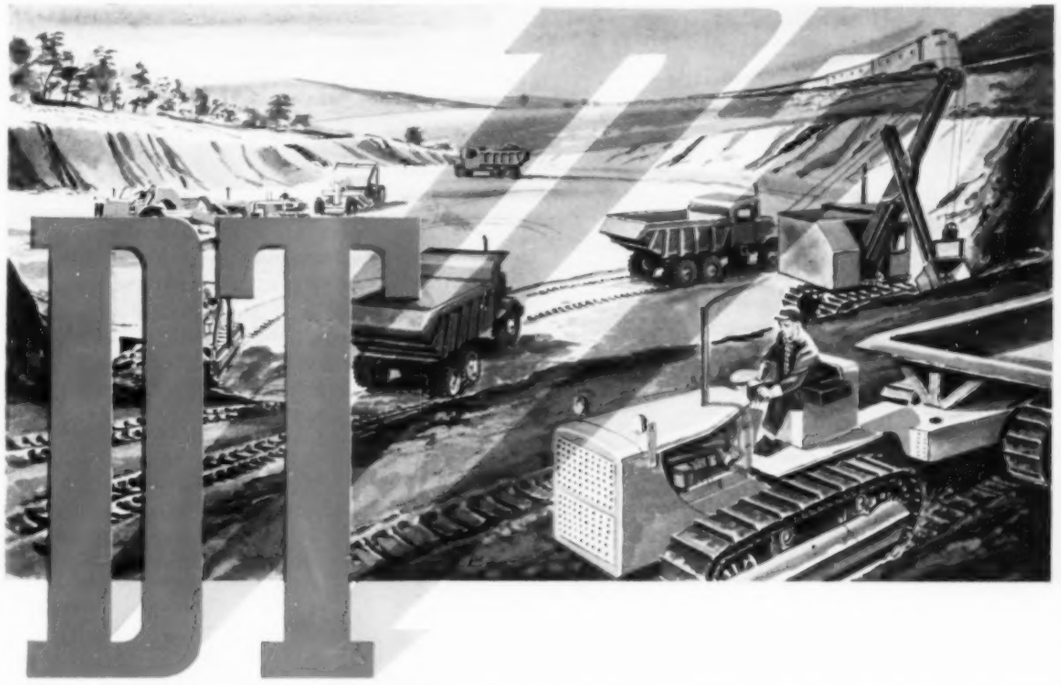
27-Ton Rear Dump

A new size Rear Dump, with 27-ton payload rating, has been announced by Euclid Division of General Motors Corporation. Known as Model R-27, this Euc is equipped with either 300 hp Detroit diesel or 335 hp Cummins engine, Allison Torqmatic Drive and 18.00 x 25 tires on all wheels are also featured. Top loaded speed is 34 mph. The 4-speed Torqmatic Drive has automatic converter lockup to provide maximum economy when hauling at high speeds. A Torqmatic Brake for safe, economical braking on steep grades is standard equipment. Both the standard and optional quarry type body are 18 cu yd struck capacity. Designed to work with big loading equipment, the R-27 has a low loading height of 9 ft 10½ in. and a dumping angle of 61°. The all-welded tapered body, raised by twin double-acting 2-stage Euclid hoists, sheds the load clean and fast. Additional information and specifications are available from Euclid dealers or Euclid Division, General Motors Corporation, Cleveland 17, Ohio. (ITS NEW)

Rubber Expansion Joints Catalog

General Rubber Corporation, Tenafly, N. J., has released a new 6-page, 2-color bulletin giving complete information on their new line of rubber expansion joints and flexible pipe. GRC Expansion Joints and Flexible Pipe are available in three styles: (1) Style 1000—For Vacuum Operation, (2) Style 1025—For Pressure Operation; and, (3) Style 1050—For Vacuum and Pressure Operation. Standard pieces are recommended for working temperatures to 180°F. and pressures to 150 p.s.i.g., or 30" Hg. vacuum service. Higher temperature and pressure GRC units are available for special service. GRC Expansion Joints are available from ½ in. to 72 in. i.d., in standard straight-through or reducing types, with or without filled arch or liner, and with either full-faced or enlarged slip-over pipe ends. GRC flexible pipe is available in ½ in. to 72 in. i.d., in lengths up to 50 ft. and furnished with either full-faced flanges or enlarged slip-over pipe ends. General Rubber Expansion Joints and Flexible Pipe are being used in Power Stations, Air Conditioning Systems, Water and Sewage Works, Chemical and Petroleum Processing Plants, Pulp and Paper Mills and Ships as flexible connections in pressure and vacuum systems handling water, brine, gases and chemicals.

HERE IS IMPORTANT INFORMATION! The completely new 1958 edition of the **DIESEL ENGINE CATALOG**, Volume 23, is now available. If you design, purchase, sell, operate or service diesel, dual fuel or gas engines, the Catalog is essential to you. This giant, 400 page, 10½" x 13½", fully illustrated reference book has been revised, rewritten and brought up to date completely from cover to cover. Send your order in now for this limited edition, which costs $10 postpaid plus California sales tax where applicable. Send checks or company orders to **DIESEL ENGINE CATALOG**, 816 N. La Cienega Blvd., Los Angeles 46, Calif.



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℞ Prescription Filtration
FOR DIESEL
FUEL AND LUBE OILS
WIX offers many outstanding filtrants especially engineered to provide a Prescription type Cartridge for your individual operating conditions.
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Contamination in fuel and lubricating oils spells "down time" for repairs and frequent maintenance, unless this damaging dirt and sludge is kept out of your Diesel engines. You can always rely on WIX Engineered Filtration for a continuous flow of clean Diesel fuel and lube oils—WIX prescription type filtrants meet the toughest performance requirements of *every* engine operation! That's the reason WIX is in such wide use as original filtration equipment, as well as the first choice in countless places wherever Diesels are on the job.

Your engines can have this greater protection and longer service life at an amazingly low cost. Put WIX to work for you; keep your Diesels "out-of-the-red," and free from expensive down time!

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West Coast News

By James Joseph

TO W. W. CLYDE Construction Co., Springville, Utah, a 250 hp Cummins NT-6 engine to repower a Kenworth tractor.

THE U. S. NAVY Dept. has taken delivery on twenty 20-kw generator sets combining GM 2-71 engines and Kurz Root generators, for installation in LC-U's. Sale by Portland's Gunderson Bros. Engineering Corp.

FOR THE halibut schooner *Pacific*, owned by Seattle's John Overbo, an Allis-Chalmers DAMR 2505 diesel with 3:1 Western reduction-reverse gear.

TO J. H. POMEROY Co., Inc. San Francisco, two Fairbanks-Morse model 49B4½ 126 hp diesel engines.

SAN Francisco's American Independent Oil Co. has purchased a Fairbanks-Morse 6-cylinder model 49B4½, 180 hp diesel engine.

LUPPINO & Sons, Yakima, Wash., has repowered a Peterbilt 350 truck with a Cummins NH-220 diesel. Sale by Cummins Diesel Sales of Washington.

PETE NICHOLOFF'S tug *Siren*, working out of Seattle, has been powered with an Allis-Chalmers DCMR 1879 diesel with 3:1 Twin Disc model MG-201 reverse and reduction gear. Sale by Pacific Fishing & Trading Co.

TO H. P. VAN Valkenburgh Co., Santa Cruz, Calif., two Fairbanks-Morse Model 49, 300 total hp diesel engines.

AS A PUMP engine: a GM model 4030-C, 4-71 unit to the U.S. Army's Beaver Storage Depot, in Oregon.

DELIVERED: a Cummins NH-220 diesel to Yakima, Washington's Highland School District to repower a Crown Coach AD-743 Bus.

A GM 6-110 with 3.7:1 Allison hydraulic reverse-reduction gear has been installed in a tugboat operated by Oregon's Mirene Company.

INLAND Navigation Co. has purchased a GM 3-71 generator set from Portland's Gunderson Bros. Engineering Corp.

BAKERSFIELD, Calif's Oilfields Trucking Co. has taken delivery of a Cummins 250 hp NT engine to repower a Kenworth CG 825 Truck.

INSTALLED in David Halliburton's 35-ft cabin cruiser, two GM 3-71s, matched pair with 1.5:1 reduction gears swinging 21x17 props. Craft harbors in Southern California.

THE 82-FT PURSE seiner *North Queen*, owned by Andrew Xitco, Terminal Island, Calif., has been equipped with a GM 6-110 diesel swinging 65x55 prop. Reported by Crofton Diesel Engine Co., Inc.

TO BUNNING Transfer Co., Rock Springs, Wyoming, a Cummins NH-220 diesel to repower an Autocar truck. Sale by Cummins Intermountain Diesel Sales Co.

TO BASHAW Equipment Co., Anchorage, Alaska, two model 45C3-1/8, 5¼ hp Fairbanks-Morse diesel generator sets.

J. P. LOUBET, Pomona, Calif. has taken delivery of a Cummins NH-220 diesel to repower an International DCO-405 truck.

TO SAN Francisco's Daiichi Bussan Kaisha, Ltd., a 2-cylinder, model 49, 58 hp Fairbanks-Morse power unit.

A GM 6-71 Marine diesel, with 3:1 Allison hydraulic reverse-reduction gear has been installed in a tugboat owned by Portland's Chelsea Knight.

LMOA Meeting Coming Up

The 1958 Annual Meeting of the Locomotive Maintenance Officers' Association will be held September 15, 16, and 17 at the Sherman Hotel in Chicago. Economy is the theme of the convention program, which promises, as always, to be intensely interesting to railroad men working with diesel locomotives. Specific papers will be given within the following general topics at the meeting: General Diesel Maintenance Subjects; Diesel Material Reclamation; Diesel Engine Maintenance; Shop Equipment; Steam Generator Maintenance and Water Treatment; Diesel Electrical; Diesel Mechanical—Other Than Engine; Fuel and Lube Oil. Plan now to attend this important meeting.

Five New Posts On Sales Staff

Five new posts on the sales staff of the Delco-Remy Division were announced recently as an important phase of a program which will broadly expand the Division's marketing and merchandising activities throughout the country. Named to the new positions as announced by Divisional General Sales Manager P. E. Bardsley are: John D. Baker, Assistant General Sales Manager responsible for the planning and direction of original equipment sales activities. Dan T. Fisher, Assistant General Sales Manager responsible for all replacement and after-market sales and service. Forrest A. Stinson, Manager of Detroit Regional Sales, where a new office is to be established at a suburban location. Frank R. Hubler, Manager of Anderson Regional Sales, responsibile for original equipment sales with Delco-Remy customers outside the Detroit area. Darwin E. Pearson, Manager Central Sales Office, responsible for price and market analyses, order handling and sales office administration. Mr. Fisher, Mr. Baker and Mr. Pearson will report directly to General Sales Manager Bardsley. Mr. Stinson and Mr. Hubler will report to Mr. Baker. All of the men named to these newly designated positions are veterans of many years of service with Delco-Remy and thoroughly acquainted with the complete Delco-Remy line of products, the announcement pointed out.

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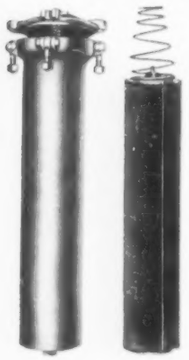

Fig. 1555BF Duplex Filter uses factory packaged laminated fiber disc filtering elements. Each filter comprising duplex operates independently or in parallel. Wide range of sizes.

Fig. 1576 Bag-Type Pressure Filters feature inexpensive, completely disposable filter cartridges. For filtering fuel oil, lubricating oil and wide variety of fluids.

AT LEFT: Fig. 1555-4L Filter and laminated disc cartridge. High flow rate; low pressure drop. Excellent micronic efficiency. Cartridges interchangeable with all other Nugent Bag or Depth Type cartridges.

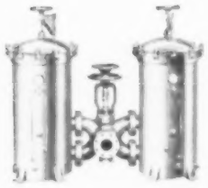

Fig. 1554AN-4L7 Duplex Strainers provide the advantage of uninterrupted flow, without by-passing, while cleaning the strainer baskets. Each strainer comprising duplex uses 7 strainer baskets Fig. 1554A-4L.

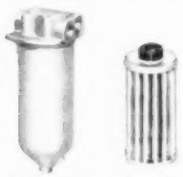

Fig. 1490AM-0 star-shaped extended area strainers offer increased free screen area over round basket type.

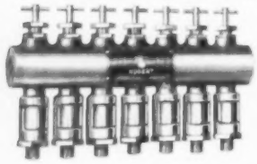

Fig. 1503F Multiple Pressure Oilers are available with from 2 to 24 feeds.

Fig. 524 Sight Feed Valves with removable glass. ¼" to ¾" IPS.

Fig. 1575 Pressure Sight Flow Lubricator. Single units or multiples to 15.

Fig. 1366E Sight Flow Fittings for indicating flow of liquid in a pipe line. Available in brass, cast iron, steel or stainless steel.

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Michigan-Ohio News

By Jim Brown

TWO Case Terratrac diesel crawlers have recently been purchased from the J. R. Panelli Equipment Co., Inc. of Detroit; one was a model 500 equipped with a Continental model GD 157 engine which went to Michigan Sewer Construction Co. of Detroit and the other was a model 1000 equipped with a Continental model JD328 diesel which went to Carl Taylor of Ferndale, Michigan.

S. L. MAC McFadden has recently joined the Cummins Diesel Michigan Inc., organization as fleet sales representative to work jointly with manufacturers of Cummins diesel powered equipment and their large fleet customers. Mac was formerly associated with the home office sales department of Reo Motors, Inc., in Lansing before managing their Detroit branch until July 1957. Prior to the Reo affiliation he was ten years with the Brockway Motor Company, Inc., as manager at Baltimore, Md., and later as Connecticut Division Manager.

THE HUBER-Warco Company, Marion, Ohio has announced the appointment of Larry J. Weiser as a district sales representative. His territory includes the Upper Peninsula of Michigan.

DETROIT Veterans Cab Co. is having one of their taxi cabs converted from gasoline to diesel. Cummins Diesel Michigan Inc. is doing the job for them with a 75 hp model J-4-B. This installation is believed to be the first American diesel in an American cab.

A BUCYRUS-Erie model 22-B transit crane was recently delivered to Tom Robinson & Son, Inc. of Jackson, Michigan. The new crane was purchased from Wolverine Tractor & Equipment Co. and was powered by a GM Detroit diesel engine.

TELFORD Equipment Co. has been appointed distributor in the Lower Peninsula for the Cedarapids products of the Iowa Mfg. Co. The Telford firm maintains headquarters in Lansing, Detroit and Grand Rapids. A complete stock of repair parts and service facilities for its new line have been set up in each of the Tilford locations.

CYRIL J. BURKE, Inc. of Detroit recently sold a model SP-54 self-propelled Bros roller equipped with a Hercules DD 226 diesel engine. The Bros roller will be used for compaction of road beds by the Kutchins Paving Co. of Lansing, Michigan.

THE UTICA Div. of Curtiss-Wright Corporation has announced the appointment of Industrial & Marine Supply Company of Hazell Park, Michigan as Michigan distributors for Mercedes-Benz diesel engines.

G. HARVEY Rogers has been appointed product manager for Clark Equipment Co. equipment handled by the Miller Equipment Co. of Grand Rapids and Livonia, Michigan.

THE SAGINAW County Road Commission has accepted delivery on a model TD 18A International crawler. The sale was made by Wolverine Tractor & Equipment Company.

RAY C. CALL, Inc. of Steubenville, Ohio reports the sale of a model 4029-C GM Detroit diesel engine. The new engine was purchased by Martin Dreher of Strasburg, Ohio to repower a 50 kw dc generator. The generator is used for electric power in a coal mine and formerly used two gasoline engines for powering purposes.

HARNISCHFEGER'S largest shipment of excavators in several years left Escanaba, Michigan recently for Maine. Purchased by the Maine State Highway Dept., the sale consisted of 11 three-quarter yard crawler type machines rigged with shovels. They were loaded onto six flat cars for the trip to Maine.

TWO 75 kw dc generator sets powered by GM model 6150 Detroit Diesels were sold to the Ohio Edison Company for their Stratton Station in Empire, Ohio. The new generator sets will be used for standby service and peak load operation, and were purchased from Peninsular Diesel Inc. of Detroit, Michigan.

DOLLMER Sand & Gravel Co. of Pigeon, Michigan has accepted delivery on a model HS-7-P 210 hp Cummins diesel engine. The engine was purchased from Cummins Diesel Michigan, Inc. and will be used to power a 6 in. gravel pump.

THE addition of a 70-ton capacity four-axle truck crane to its line of construction equipment is announced by Baldwin-Lima-Hamilton Corp., of Lima, Ohio.

MICHIGAN'S Clark Equipment Co. has signed an agreement with Toyo Umpanki Co., Ltd., of Japan, under which the Japanese firm will produce Clark industrial trucks and construction machinery. Japan is the sixth foreign country in which Clark has one or more licensees.

MICHIGAN Foundry Company of Muskegon, Michigan has accepted delivery on a 3055C GM Detroit Diesel engine. The new engine was purchased from Peninsular Diesel Inc. and will be used to power a Lorain model TL 25 K ¾ yd crane.

A 23,000 LB Oliver OC-15 angle dozer, fully hydraulic, and powered with a Hercules 110 hp 6 cylinder diesel engine has been purchased by the Oakland County Road Commission from Cyril J. Burke Inc. of Detroit.

WILLIAM Spiropoulos of Toledo, Ohio; a broker for C. A. Conklin Truck Lines of Toledo, is converting the first 2 of his Brockway model 240XW tractors with Cummins model NH-180 diesel engines. Future plans are to convert his entire fleet to Cummins diesel.

THE CITY of Battle Creek, Michigan has accepted delivery on a Hough model HUD Payloader. The sale was made by Wolverine Tractor & Equipment Company of Detroit and Grand Rapids.

Missile Support Contract

A $5,000,000 missile support contract has been awarded Consolidated Diesel Electric Corporation by the United States Army Corps of Engineers. Norman I. Schaffer, Con Diesel president, announced recently. The order, directed to the Company's Power Equipment Division, calls for several hundred 45 kw, 400 cycle, precise power generators, completely enclosed and winterized, for use in missile pre-launching control and communications. A unique feature of the equipment is an electric governor which automatically and instantaneously regulates the flow of fuel to the diesel engine in proportion to the electric load on the generator. Another feature of the basic equipment is its worldwide application. The units have a capacity to deliver precise power within the temperature range from minus 65 to plus 125 degrees Fahrenheit, and at altitudes up to 10,000 ft. First shipments are scheduled next September.

DIVISION A — Federated Rural Electric Association, Jackson, Minn.

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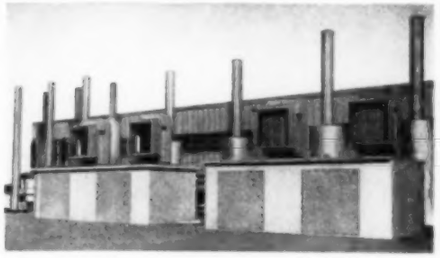

DIVISION B — Lea County Electric Cooperative, Lovington, New Mexico

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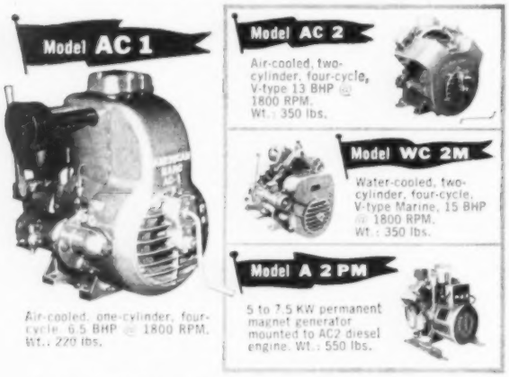
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Model WC 2M
Water-cooled, two-cylinder, four-cycle, V-type Marine, 15 BHP @ 1800 RPM. Wt.: 350 lbs.
Model A 2PM
5 to 7.5 KW permanent magnet generator mounted to AC2 diesel engine. Wt.: 550 lbs.

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Florida Diesel News

By Ed Dennis

THE 65 foot *Anna Jackman* built at the J. F. Bellinger & Sons Shipyard, Atlantic Beach, for the Presbyterian Missionary at Juneau Alaska, is powered with two model NHM600 Cummins diesels. Each are rated 200 hp at 2100 rpm.

HAROLD CLARK, general sales manager of the Utica Div., Curtiss-Wright Corp., announced that the J. W. Goode Co. of Fort Myers, have been appointed the Florida regional distributors for the Mercedes Benz line of diesel engines.

THE *Miss Golden Isles*, an 85 ton dredge built by Dade Drydock Corp. and costing ¼ million dollars, was put to use recently by Layne Inc. of Hallandale. Specifications were a D397 turbocharged, series D Caterpillar diesel. Cotta transmission and Falk flexible couplings. The Georgia Iron Works pump (14x12) pumps 250 cu yds of material per hour. Maxim exhaust silencers are used. For electrical power, *Miss Golden Isles*, has a 2 cyl Petter 12 bhp 6½ kw diesel generating set plus a D337 series F Caterpillar generating set rated 187 kva 240/480 volts 60 cycle 1800 rpm.

IN JACKSONVILLE, the Bennett Industrial Parts Co., supplied a model X 4 cyl Ford marine diesel engine for the 38x13 fishing craft *San Reef*. This 220 cu in. diesel is rated 68 hp at 2400 rpm.

FOR THE Cape Coral land development project near Fort Myers on the Caloosahatchee River, 6 Allis-Chalmers TS-160 motor scrapers (9½ cu yds heaped) powered with the Allis-Chalmers TDS-516 four cycle supercharged diesel developing 155 hp at 2200 rpm from Square Deal Machinery of Orlando.

FLORIDA will get 169 million dollars from the federal highways program for road construction in the next 3 years. This ought to be a real good shot in the arm for Florida's dieselized construction equipment distributors and dealers.

THAT Michigan, #125-A scoop-mobile that R. E. Vaughn Construction Co. received recently, is powered with a model 195 DLC Waukesha diesel engine. This diesel is rated 84 hp at 2000 rpm and the Torqmatic drive is from Allison.

CUMMINS Diesel Engines of Florida at their Jacksonville branch, replaced a gasoline engine in an International hiway tractor for C. W. Day of Port Orange with a 175 hp J 6B Cummins diesel. A similar model was also installed in a Diamond T for Pioneer Truck Rentals of Palatka.

WITH HIGH water in the low lands from Lake Okeechobee south and the rainy season yet to come, 1958 shows prospects of being the year in which floods may test the U. S. Army Engineers Central and South Florida Flood Control Project. So far, 6 pumping stations have been completed. The 22 dieselized units have a total design discharge capacity of 17120 cfs of water.

FOR AN electric power plant addition at the Air Force Missile Test Center, Cape Canaveral Annex Patric Air Force Base, one 10 cyl 1600 hp model 38D8⅛ Fairbanks Morse diesel generating set plus a 5½ hp model 15C3½ unit and a model 48AG4½ 20 hp diesel generating unit.

THREE Euclid S-7 seven yard hydraulic scrapers, powered with General Motors 4-71 diesels and Fuller transmissions and Bendix-Westinghouse air compressors were delivered to A. P. Frizzelli Construction Co. of Punta Gorda by the Lewellyn Machinery Co. of Tampa. These dieselized earth moving machines are moving 12 to 1500 cu yds of sand in a 10 hour day.

TWO TD18 International tractors with hydraulic dozer blades went to the Mackle Co. in Port Charlotte and a similar model to the Cape Coral Land Development Co. These crawler tractors are powered with a 6 cyl 105 drawbar hp International diesel engine.

TAMPA Marine is building several twin screw 146 ft wooden hull mine sweepers for the Navy. These will be powered with the Cleveland GM diesel engines model 8-278-A, 820 bhp at 750 rpm.

AT ST. Petersburg, the Peninsular Telephone Co. has installed a 350 kw Waukesha diesel generating set for emergency power while a 250 kw unit was installed in their Lakeland plant.

THE 65x20 ft *Admiral II*, a twin screw party fishing vessel of Cortez and owned by Jim Sage, was powered with a pair of General Motors 6-71-E diesel engines with GM 2:1 hydraulic rtr gears for a speed of 15 mph by the General Engine & Equipment Co. of Tampa.

THE MERRILL-Balfe Div. of Merrill-Stevens Drydock Co. in Miami, has been appointed the new dealer for the Petter line of diesel engines for southeast Florida.

TWO General Motors 6-71 series diesel engines will power the 100 kw Delco generators to be used for electrical power in the new #7 pump station of the flood control project being constructed on the North New River Canal, 26 mi south of South Bay.

A TURBOCHARGED 600 hp Cummins diesel was installed in the tug owned by Milliny & Sons of West Palm Beach. The model VT 12 has a bore and stroke of 5½x6 and a piston displacement of 1486 cu in., Capital 6:1 hydraulic r&r gears, and was engineered by Cummins Diesel Engines of Florida, Inc. of Coral Gables.

THREE Caterpillar DW 15 four wheel tractors with Athey PD 15 side dump rock wagons, powered with Caterpillar 186 hp diesel engines, were delivered to the Three Bays Improvement Co. in Rockdale by Shelley Tractor & Equipment.

THREE 1500 watt Petter diesel auxiliary generating sets were installed on the 3 newly lauched 67 ft Diesel Engine Sales shrimp trawlers, *Falcon*, *Campeche Gal*, and *Alona Girl*. Main propulsion is furnished by Caterpillar D342 diesels rated 150 hp at 1225 rpm; Snow Nabstedt 3:1 r&r gears and Twin Disc power takeoff are also featured.

Waukesha Buys Le Roi Commercial Engine Business

The Le Roi Division, an operating unit of Westinghouse Air Brake Company, Milwaukee, Wis., has announced the sale of the assets of its engine business to Waukesha Motor Company, Waukesha, Wis. The line of internal combustion engines made by the Le Roi Division, along with certain inventories, special tools and equipment, make up the major assets involved in the transaction. No financial consideration was disclosed for the agreement, which became effective April 1, 1958. Frank Zielsdorf, general manager of the Le Roi Division, stated that "the removal of this engine line will permit the division to concentrate its efforts on the air compressor and tool business and to obtain a greater share of the markets for this type of equipment." The Le Roi Division produces stationary, portable and self-propelled air compressors and rock drills for the construction, industrial and mining industries.

The heavy duty engines made by the Le Roi Division ranged in size from 1 to 12 cylinders and from 6 to 675 hp. They were for both truck and stationary applications and were sold to the industrial, transportation, petroleum, agricultural and military markets. Mr. Zielsdorf stated that the division will continue to manufacture smaller gasoline engines in the 30 to 50 hp sizes for use in powering its own products. Le Roi was founded in 1913 as the Milwaukee Machine Tool Company. While it has been manufacturing heavy duty gasoline engines since the end of World War I, its major volume in recent years has been in its other lines. The Milwaukee organization has been a division of Westinghouse Air Brake Company since 1952. Le Roi has branch plants in Cleveland and Greenwich, Ohio in addition to its West Allis, Wisconsin operations.

Adopts New Sales Program

Marking a major change in its sales policy, Hercules Motors Corporation has adopted a new program placing substantial emphasis on engine sales by its distributor and dealer organizations, it has been announced by William L. Pringle, president. Mr. Pringle said that the new program will place the company's nationwide distributor organizations in a position to sell original equipment manufacturers in their territories at a price similar to that of the factory. The local contact means better service for customers than the factory could previously provide in sales follow-up, warranty and parts. While the Hercules factory will continue to contact and sell the larger volume users of its engines, under the new policy its distributors and dealers will have greatly enhanced conditions under which to operate. These include advantages in the area of discounts, warranty, factory support, as well as an expanded advertising and sales promotion program.

Cooper-Bessemer Appointments

Grant C. Woodard, General Sales Manager of Cooper-Bessemer has announced the appointment of Robert L. Kietzman to Sales Engineer for the Cooper-Bessemer St. Louis Branch Office. Working under the direction of F. J. Hunter, Branch Manager, Mr. Kietzman will be responsible for engineering and sales contacts with users of compressors and engines in the Missouri and Southern Illinois areas. He will work out of the Cooper-Bessemer Branch Office and Warehouse located at 1511 Locust Avenue, St. Louis 3, Missouri.

The appointment of H. F. (Harry) Neuman to the post of Sales Engineer is announced by C. R. Jones, Vice President of Cooper-Bessemer of Canada, Ltd. In his capacity as Sales Engineer, Mr. Neuman will contact users of engines and compressors in the Western Canadian territory. He will work directly from The Cooper-Bessemer of Canada, Ltd. regional office at 615 Second Street, S. W., Calgary, Alberta.

The appointment of James H. Caldwell to the position of District Service Manager, Pacific Coast, is also announced by Grant C. Woodard, General Sales Manager of The Cooper-Bessemer Corporation, Mount Vernon, Ohio. In his new capacity as District Service Manager, Mr. Caldwell will be responsible for the supervision of all Cooper-Bessemer service activities in the Los Angeles, Seattle, San Francisco and Casper, Wyoming areas. Mr. Caldwell will work under the direction of James W. Reed, Vice President and Pacific Coast Manager of Cooper-Bessemer, and will make his headquarters at the Company's Los Angeles Branch Office, 1940 Lovelace Avenue.

HERE IS IMPORTANT INFORMATION! The completely new 1958 edition of the **DIESEL ENGINE CATALOG**, Volume 23, is now available. If you design, purchase, sell, operate or service diesel, dual fuel or gas engines, the Catalog is essential to you. This giant, 400 page, 10½" x 13½", fully illustrated reference book has been revised, rewritten and brought up to date completely from cover to cover. Send your order in now for this limited edition, which costs $10 postpaid plus California sales tax where applicable. Send checks or company orders to **DIESEL ENGINE CATALOG**, 816 N. La Cienega Blvd., Los Angeles 46, Calif.

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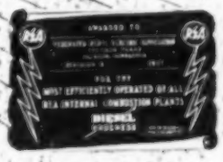

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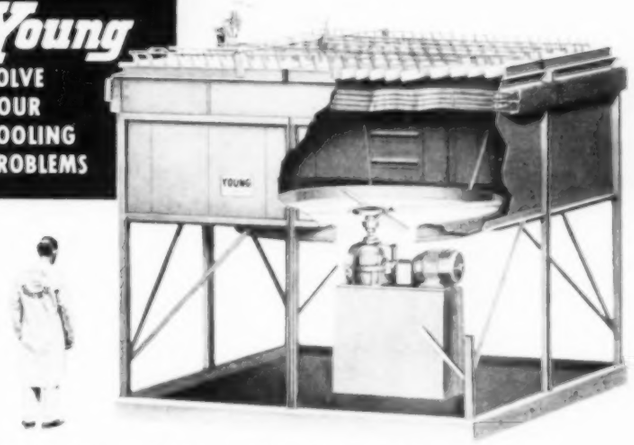

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ALL METAL
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DBZ — for high speed, heavy duty drives

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4 Visual Inspection While in Operation
5 Original Balance for Life
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8 No Maintenance

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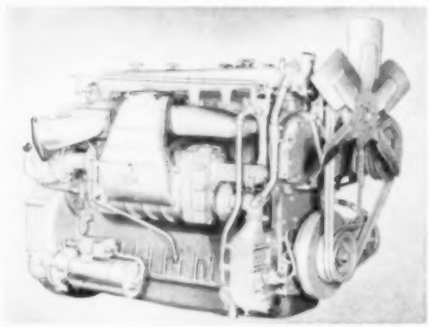
THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U. S. A.

Joins Agency Chicago Group

Henry J. Barbour

Henry J. Barbour, recently Manager of Advertising and Public Relations for Fairbanks, Morse & Co., joined Donahue & Coe's Chicago staff on June 1st. He will serve as account supervisor and also as a specialist on trade, industrial, engineering and class media. Mr. Barbour, who has been Manager of Advertising and Public Relations with Fairbanks, Morse & Co. for a number of years, joined that company in 1924 as Advertising Manager of their Dealer Division at their Beloit, Wisconsin works. In 1928 he was transferred to the Chicago headquarters where he became Manager of Public Relations. In 1954 he was promoted to Manager of Advertising and Public Relations, which position he has held until his present change. During World War I Mr. Barbour was an officer in the United States Navy, and during World War II he had charge of the community and industrial relations programs at the company's various plants throughout the United States promoting incentive programs in cooperation with the United States Navy. During this time he originated a father and son type of advertising featuring a father in the plant at his job and the sons or daughters in the Armed Services. Weekly ads were run in the various plant towns for the entire period of the war. For this he was given a citation by the United States Navy. He is a member of the Chicago Rotary Club, Union League Club of Chicago, Public Relations Society of America, the Newcomen Society of England, Masonic Lodge, Knights Templar and Shrine. He is a Past President of the Chicago Sales Executives Club.

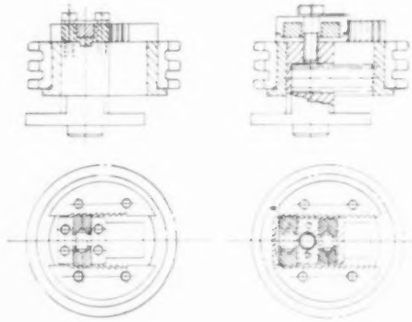
Lightweight Truck Diesel



A new lightweight diesel engine for trucks has been introduced by the Detroit Diesel Engine Division of General Motors. Its light weight attained through the liberal use of aluminum alloys in the cylinder block and other major components permits substantial increases in truck payload capacity. The engine, a six cylinder model, is the latest addition to the Division's new line of 71-E truck engines. Its weight of only 1710 lbs establishes an attractive low weight for truck diesels. Despite its low weight the new engine retains all the durability features in GM diesel standard cast iron models. Its design includes the recently introduced four-valve head and new high-economy fuel injectors and pistons which further improved the performance of the already efficient Series 71 engine. The new unit develops its peak horsepower at 2100 rpm with its maximum torque of 577 lb ft occurring at 1200 rpm. Complete specifications and installation data on the new engine may be obtained from Detroit Diesel Distributors or by writing the Detroit Diesel Engine Division of General Motors, Detroit 28, Michigan.

Improvements In Chain Tensioners

Automatic tensioning devices are used in chain drives to maintain a reasonably constant tension in the chain. This is done by taking up any slackness which may occur in service because of the lengthening of the chain due to wear of its links. A well-known method of achieveing this is to urge the tensioner sprocket, under the influence of a compression spring, in a direction toward the chain. However, it is necessary to limit the backward movement of the tensioner caused by fluctuating loads in the chain. This may be done by using a ratchet and pawl mechanism. A fine degree of adjustment should be provided. But until now, there have been difficulties in obtaining the required fineness. Because precise control depends on the movement allowed by the teeth of the ratchets, very small movements cannot be obtained. This is due to limitations imposed on the teeth's pitch by the strength necessary to withstand loads placed on the sprocket by the chain. Also there is a need for a degree of freedom, or relief, just at the point where the pawls engage the ratchet teeth.



1. 2.

F. Perkins Ltd., diesel engine manufacturers, of Peterborough, England, has overcome these difficulties by providing the pawls with a number of teeth that engage the ratchet teeth simultaneously. This allows a reduction in pitch of the teeth, without reducing the strength of the pawl and the ratchet combination. Sketch No. 1 illustrates this construction. Another improvement can be made by providing two pairs of pawls, spaced apart by a distance of one or more ratchet teeth pitches plus a fraction of a pitch. In this way, the two pairs of pawls can engage alternately with the ratchet teeth. This increases fineness of adjustment without reducing the pitch of the teeth. Also by this method the pawls can be made with a number of teeth of reduced pitch to further improve fineness of adjustment, without impairing the strength of the pawl and ratchet combination. For still finer adjustment, the number of pawls can be increased. Sketch No. 2 shows a tensioner provided with two sets of pawls. (ITS NEW)

New Filter Development

The latest CFC Honan-Crane Filter was developed by Indiana Commercial Filters Corporation to provide micro-clarity of hydraulic fluids, fuels and mineral oils. Two new interchangeable cartridges may be used; Flo-Pac 5 for removal essentially of all solid contaminants down to 5 microns in one pass; Type K cartridge utilizing Type T Cranite (fuller's earth) for removal of solid and dissolved contaminants. Flo-Pac 5 is made from resin-impregnated pleated paper and has 6300 sq in. of filtering surface. It will not disintegrate or be affected by water or water solutions. It is inert and will not remove oil additives. Flo-Pac is designed for water-base hydraulic fluids, refined fuels such as gasoline and refined diesel fuels, and on any type of mineral oil. It is especially recommended for oils of high viscosity because of its minimum resistance to flow. It may be used for by-pass or full-flow filtration.

The new Type K Cranite cartridge was specifically designed to meet JIC hydraulic standards. It contains approximately thirteen pounds of special Type T Cranite (fuller's earth) enclosed in a metal container. It removes water, acids, tars and asphaltenes as well as solid contaminants. Type T Cranite is processed at extremely high temperatures to make the granules hard and especially resistant to water. The Type K cartridge is interchangeable in any filter which will receive a Standard Navy Large Cartridge. Literature and price information may be obtained from Indiana Commercial Filters Corp., Lebanon, Ind.

Deltic Locomotives For British Railways

A fleet of locomotives of the Deltic type, the most powerful diesel locomotive operating in Britain, which was designed and built by the English Electric Company is being ordered by The British Transport Commission. The locomotives will go into service between London, Newcastle, Edinburgh and Leeds. The locomotive is the 3,300 hp diesel-electric Deltic and the order being placed with its makers is for 22. The prototype locomotive was designed and built within The English Electric Group after D. Napier & Son had successfully developed a new light-weight diesel engine. The locomotive was offered for trial to British Railways and, following a successful period in service since October 1955, 22 are now being ordered as part of the Railways' re-equipment and modernization program. These locomotives will be designated Type 5, and will be built at The Vulcan Foundry Limited, Newton-le-Willows. With a total weight of only 106 tons and a rating of 3,300 hp, the Deltic has one of the lowest weight/power ratios ever achieved in diesel locomotive design at 72 lb per hp. The axle load of 18 tons gives it a wide range of route availability on the British Railways' system, and most sections of standard and broad gauge railway systems overseas. It is geared for a maximum speed of 105 mph. Primary power comes from two Napier Deltic high-speed, light-weight, two-cycle diesel engines, each of which drives a 1,100 kw main generator and a 45 kw auxiliary generator. The main generators supply power to six nose-suspended axle-hung traction motors, while current at a constant low voltage from the auxiliary generators is used for battery charging, main generator field excitation and the operation of all auxiliary machines.

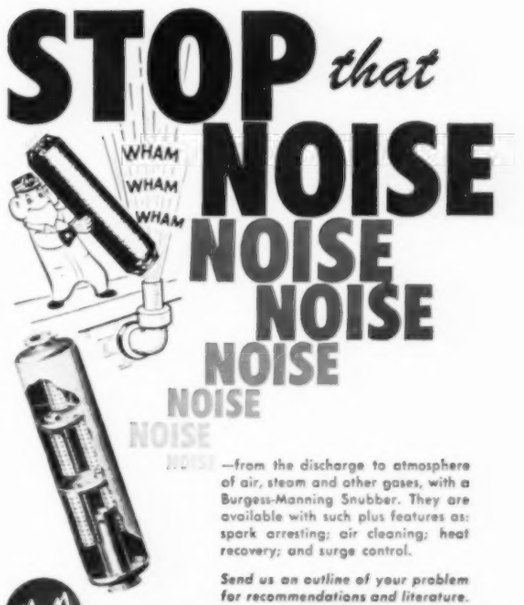
Generator Ordered

The City of Erie, Kansas Municipal Light Plant has ordered a 1563 kva, 1250 kw, 360 rpm, 2400 volt Electric Machinery generator to be driven by a Worthington diesel. The unit is scheduled for delivery in August of 1958. The generator is the second E-M machine to be purchased by the City of Erie.

Sales Organization Expanded

Allison has launched a major selling drive for fully-automatic transmissions on medium and heavy highway trucks, according to an announcement by J. A. Lane, Transmission Sales Manager for the Allison Division of General Motors. The expanded sales organization is headed by John K. Knighton, who came to Allison a year ago after extensive sales and merchandising experience both within and outside General Motors. Mr. Knighton has been appointed Assistant Sales Manager for Highway Transmissions, Mr. Lane explained. "After an extensive survey and market analysis, a complete sales program has been established and first steps are underway to build up the selling organization which will be responsible for implementation of the program," Mr. Lane added.

The expanded program contains three major parts: 1. Expansion in the selling organization to make possible increased selling contact with the distributive organizations of the truck companies, truck body and equipment manufacturers and major Fleet Operators. 2. An increased advertising program covering two-page black and white spreads in leading business and fleet trade publications beginning in April. 3. A series of spring and fall direct mailings to 50,000 Fleet Operators using 10 or more vehicles in industries where the Allison automatic transmission has outstanding economic application.



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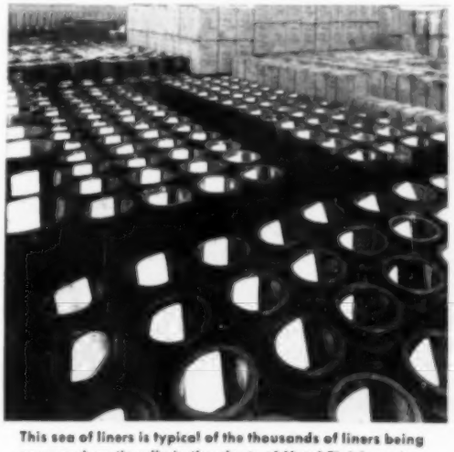

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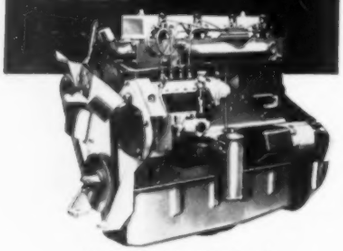

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Appointed to Advertising Post

Charles F. Doepke

Robert H. Morse, Jr., President, has announced the appointment of Charles F. Doepke as Manager of Public Relations and Advertising for Fairbanks, Morse & Co. Mr. Doepke succeeds Henry J. Barbour, who will remain with the corporation for some time as counselor on advertising and public relations. Mr. Doepke joined the company in 1941 and has served in the Purchasing Department, as liaison with the Mexican subsidiary, as assistant to the General Sales Manager and presently as staff assistant to the Vice President in charge of Sales.

Tug With New Air Clutch

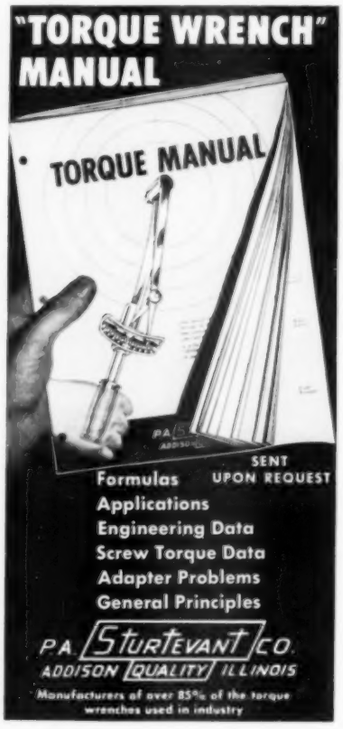
Boston recently chalked up another marine first to rank with many such important developments in its past, when the Boston Tow Boat Company unveiled for visiting experts from Atlantic Coast ports, its re-powered tug *Athena* equipped with a new clutch which gives it fingertip control. The new air-operated Wichita clutch in the *Athena* is the first such application in a salt-water tug, the only other installation being an experimental use of the mechanism in a Great Lakes tugboat. Company officials and visiting tugboat operators and engineering specialists who viewed the tug in action predict that this new clutch will probably supplant the much more expensive diesel-electric drive that has been considered the best available.

As a part of the recent renovation of the *Athena* at the General Ship and Engine Works in East Boston, the tug received a new 800 hp General Motors diesel engine, a new raised pilot house with round-the-horizon vision, and the clutch assembly. The clutch was developed jointly by the Cleveland Diesel Engine Division of General Motors and the Wichita Clutch Company, Inc., of Wichita Falls, Texas. It consists of a pair of disc type clutches actuated pneumatically by rubber tubes which force friction discs and floating plates together. The new clutch permits the maximum of speed and maneuverability essential to tugboat operation, providing a counterpart to the automatic transmissions or fluid drives of modern automobiles. It has positive control of propeller speed throughout the entire speed range, and operates smoothly with a single remote lever control in the pilothouse or any other station on the vessel. Using the new air clutch, the tugboat master gets quick response from his vessel, starting quickly, stopping fast and being able to turn the tug within its own length. ITS NEW

New Bearing Plant

Pioneer Motor Bearing Co. recently moved into its new plant in South San Francisco after 37 years operation in San Francisco. Well located in a growing industrial park area close to the International Airport, Pioneer has built a 22,000 sq ft building on 1½ acres for ample parking and

future development. Plant layout is spacious, well lighted and designed to assure customers of consistently fine products produced in the shortest possible time to custom specifications. Pioneer Motor Bearing specializes in the manufacture of sleeve type bearings and bushings in a wide range of sizes for diesel engines, turbines, gear boxes and other industrial machinery. Their complete manufacturing facilities and experience are also geared for promptly handling rebabbitting service work on all types of sleeve bearings, according to W. P. Bardet, sales manager.



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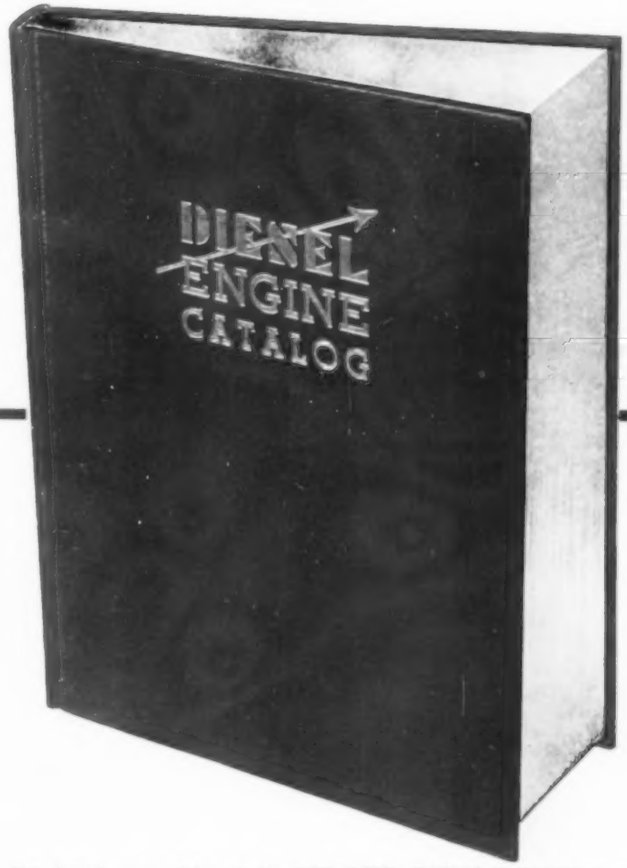

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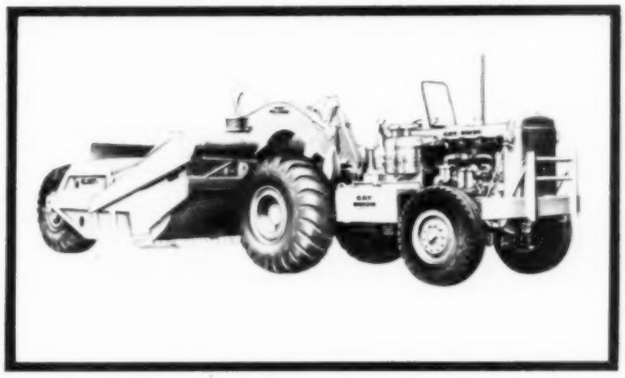

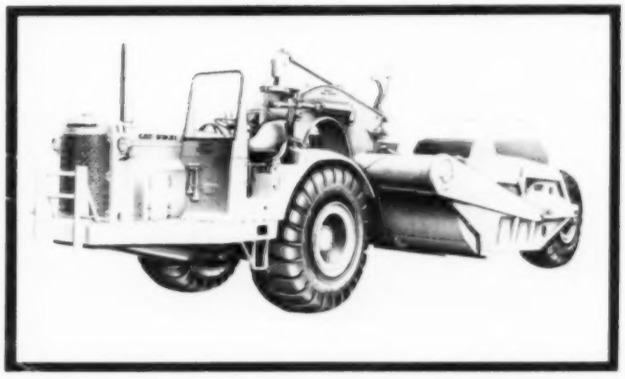

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